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International Journal of Orthodontia and Dentistry for Children

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International Journal of Orthodontia and Dentistry for Children

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International Journal of Orthodontia and Dentistry for Children

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VOL. 20

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No. 6

ORIGINAL ARTICLES

THE TREATMENT OF DENTAL ANOMALIES*

B. E. LISCHER, D.M.D., ST. LOUIS, MO.

As a science develops, its methods are improved and its aids become more refined.—Professor Otto Hahn †

THE treatment of dental anomalies by dentists was undoubtedly practiced at a very early period in dental history, since several of the oldest books on dentistry contain chapters on irregularities of the teeth and descriptions of mechanical devices which were used for their correction. Some historians believe that Pliny, a prolific Roman author of the first century, was the first to recommend it.

The mechanisms which the pioneers used were necessarily made by hand in empirical fashion from unsuitable materials, and prior to the introduction of diagnostic methods and classifications every deformity of a denture was regarded as unique, so that each anomaly required a distinctive device for its correction. This custom involved the dentist in the technical difficulties of manufacturing appliances, which unwittingly diverted his interest from the basic principles of therapy and very likely delayed the development of the art.

In January, 1878, Dr. J. N. Farrar, of New-York, continued a series of articles in the *Dental Cosmos* on the mechanical correction of anomalies with one entitled, "Regulation of Teeth Made Easy," in which he said: "The want of system in the process of regulating has brought into existence an endless variety of apparatus, some of which have proved practical, but more have not."

Although the treatment of dental anomalies has been found to be far more difficult than the title of Farrar's essay implied, he was prudent enough to foretell our present-day standardization of orthodontic appliances. His numerous contributions to mechanotherapy undoubtedly stimulated the mass production of stock appliances and prepared the way for the many which have become a

*Read before the American Society of Orthodontists, Oklahoma City, Nov. 9, 1933.

†Science, 77: 399, 1933.

feature of our time, and which have materially lightened the work of the practitioner.

The extensive use of standardized appliances which followed in the wake of their mass production and widespread distribution has not been an unmixed good. The era of daring experiment by amateurs, ushered in by alluring advertisements in dental journals, which all too frequently exaggerated the efficacy of these wares, has, in recent years, been augmented by a wholly dishonorable traffic in appliance designing and manufacturing for individual anomalies by mechanical laboratories. This predatory exploitation of appliances has caused considerable harm and unnecessary suffering to patients, since it generally terminates in practices which yield no appreciable benefits. Too many orthodontic treatments continue to reveal the practitioner's "reliance upon habit and custom, upon a childlike acceptance of the infallibility of mechanical methods of the past, even though these methods were arrived at without scientific analysis of the facts, and, of course, without our present ability to ascertain the facts." Every experienced orthodontist knows only too well that many of his treatment difficulties lie far deeper than the technical details of mechanotherapy. That is why one may reasonably regard the apparent effusion with which some of our colleagues extol the superior advantages of a given mechanism as an ineffable commentary on their intelligence. Indeed, the obstinate indifference which many of the mechanists show toward the intricate problems which orthodontic therapy poses for critical consideration, justifies some of the prevalent unfavorable criticism of the art.

Specialization in dental orthopedics began in 1896, and many of our improvements in mechanotherapy were contrived since then. During this latter period our basic concepts have also changed very decidedly, so that it is more freely admitted than formerly that dental anomalies constitute a group of deformities of such complexity that it is most unreasonable to hope for a universal appliance, or for a flawless "system" which provides an effectual remedy for every form of deviation. That is why the old phrases, irregularities of the teeth and malocclusion of the teeth, no longer adequately express our present-day comprehension of the multiform modifications which so frequently conjoin in a given dental anomaly.

Meanwhile, it has also been definitely established that a complete diagnosis is not only an indispensable prerequisite to every treatment of an anomaly, but accurate differentiation of the various deviations of a given case, its etiology and prognosis, can never be achieved without adequate data, and *without examination of the patient*. It follows, therefore, that the treatment schemes of our latter-day "experts" of the mechanical laboratories constitute a dishonest substitute for the diagnosis; their much advertised service is pure humbug. Thus, the time is at hand when the acceptance of such misleading and untruthful advertisements of "ready-to-wear" appliances by journals and society bulletins should be branded as a tacit approval of unscientific methods of treatment. Beyond question, the eradication of this traffic is a major obligation of this Society.

If we consider the various kinds of treatment ever so briefly, we are obliged to acknowledge that mechanical methods were inadequate from the beginning

and that they have always been supplemented with other remedies; we are impressed by the fourfold nature of orthodontic therapy. Thus, historical inquiry shows that Celsus, a contemporary of Pliny, advised cutting of the gums and the timely extraction of deciduous teeth as preventive measures. These aids to treatment may be said to mark the beginning of surgical therapy for dental anomalies.

The extraction of one or more permanent teeth to facilitate the subsequent mechanical correction, or as an adequate remedy in rare instances, was recommended by Fauchard (1728) and used more or less frequently ever since. The rationale of this procedure has, of course, been seriously questioned, and in the first decade of the present century the incisive arguments for and against this measure culminated in a memorable debate between Case and Angle, but without achieving a solution.

In 1892 Angle recommended the extraction of 4|4 as a first step in the treatment of cases belonging to the first division of his Class II. The retraction of the 3|3 and occipital anchorage with semirigid attachment to the 2 1|1 2 were advised as efficient subsequent measures. In 1895 Case also recommended the extraction of 4|4 and his well-known contouring appliance for completing treatment of these anomalies.

In 1898 Angle expressed grave doubts about the feasibility of this method and by 1907 condemned it. In discontinuing extraction and adopting his imperious dogma of ideal occlusion, he followed the customary path of most of our pioneer investigators, who hoped to solve our problems by invention. Case, on the other hand, continued to apply the method to the end of his career and eagerly sought some guiding principles of diagnosis which would aid him in differentiating those anomalies in which extraction was advantageous. His critical study of the facial features of patients is too well known to require comment.

Although Case and Angle were generally on opposite sides of the debate, they labored valiantly and tried sincerely to analyze the nature of the problem which confronted them. But a complete change in the status of this phase of diagnosis came subsequently (1922) with the introduction of cephalometric methods of diagnosis by Simon.

Extraction of other permanent teeth, particularly of $\frac{8|8}{8|8}$, has been widely adopted and not infrequently provides an auxiliary aid in maintaining a corrected anomaly, although the evidence in support of this practice is not sufficiently organized. In 1849, S. P. Hullihen performed a successful operation for elongation of the mandible; and in 1896, Talbot advocated the surgical removal of portions of the alveolar process surrounding extremely malposed teeth. Surgical treatment of maxillary clefts is now preferred to artificial vela of the palate. Plastic surgery for asymmetries of the lips, chin and nose is also gaining in favor. Thus, we note that surgical correction has not only been used in the past, but for certain extreme anomalies it will, undoubtedly, win wider acceptance in the future.

Our case histories must become more commensurate and the pathogenesis of deformities must be studied in great detail before we can be reasonably certain that our mechanical methods are as efficacious as we formerly believed.

In 1918, Rogers called our attention to the very important part which function plays in the growth and development of the human denture. After many years of observation and study of his failures in treatment, he discovered the great value of exercises for the muscles of mastication in patients with dental anomalies. Definite methods of training for them and for certain facial muscles were devised and found to be efficient means for overcoming several faulty habits which are frequently found as complications. His numerous contributions have actually provided us with a third group of remedies and mark the beginning of what we might appropriately term *myofunctional therapy*.

Those of you who have studied his methods recall his advice that they should be applied with caution and only after one is certain of the diagnosis. He mentions the narrow maxillary arch repeatedly, and he frequently recommends the simplification of treatment appliances. After using his methods for a decade, I became convinced of their very great value, despite the occasional criticisms which some supplied without apparent justification. As I recall the latter now and as I revert again to some of my own experiences, I have no hesitancy in recommending his methods as remedies of real merit. Furthermore, I firmly believe that in the not distant future cephalometric diagnostic methods will be used for selecting the deformities for which muscle culture is most effective. The many deviations which conjoin in dental anomalies even in a group as the so-called Class II, makes precise discernment necessary.

Proficient clinical photography has also become an essential aid in choosing cases for this form of therapy. For example, a short upper lip should not merely be observed, but recorded photographically in systematic fashion and at definite intervals. Again, a total mandibular retraction, caused by arrest of development of the rami and extreme contraction of the maxillary dental arch, offers a favorable opportunity for myofunctional therapy, whereas for a total dental and alveolar retraction with the body and rami of the mandible well developed it is positively contraindicated. The work of Rogers has definitely disclosed that our common custom of approaching the correction of every dental anomaly with a naïve mechanical bias is a noteworthy orthodontic failing.

Another recent development which is changing our basic concepts very profoundly is the advance in our knowledge of bone formation and growth. As a result of this progress, we now generally recognize that osseous structures are influenced by diet and by dysfunction of the endocrine glands. The jaws and their alveoli are not immune to such influences. Bone formation in children is now conceived as a constantly changing process. Progressive practitioners are learning to recognize various kinds of bone in radiographic records, such as spongy bone and the hard variety known as compact bone. And the mechanism of bone changes is more clearly understood than formerly, when most of our mechanical methods were designed. The processes of resorption and apposition, which are constantly taking place in bone, are factors of the utmost significance to orthodontists. When these vital phenomena are in physiologic balance all is

well. Unfortunately, apposition, which is most important for orthodontic patients, does not always follow after tooth movement has been accomplished. Our mechanisms may be ever so fine and our ministrations ever so painstaking, but if the patient is suffering from hyperthyroidism they will come to naught. In the latter condition, apposition is invariably delayed and osteoporosis exists.

The formation of new bone depends largely on an adequate amount of calcium, phosphorus, hormones and vitamins. The norms of the calcium and phosphorus content of the blood are fairly well established, so that marked fluctuations are now accepted as symptoms of disease. Variations of the basal metabolic rate have also been fixed between *minus* ten and *plus* ten, and fluctuations beyond these rates, especially of the *minus* kind, are frequently found in cases of root-end resorption (Becks). Inevitably, every practitioner comes to realize that our problems extend beyond the domain of the mechanical.

These new aids of the pediatrician, internist and endocrinologist are bound to be perfected further and in the near future should provide us with a much needed medical therapy.

In the beginning, remedies in all branches of the healing art were empirical, and first methods of treatment were seldom adequate or reasonable. Original plans of procedure generally yield to more efficient and rational methods, for the latter, presumably, are based on a more comprehensive understanding of the problems involved. Recent advances in our knowledge of dental anomalies necessitate a reconsideration and revision of our clinical procedures, so that we may conquer more of the difficulties which so often beset us and assume our responsibilities with greater assurance.

If we approach the problems of treatment in a modest manner and refuse to allow our desire to know to be suppressed by a foolish fondness for custom, we may successfully reconstruct our methods of procedure.

Our case histories and clinical records have seldom been adequate, and most of our opinions are based on uncertain, immethodical observations, when "to understand requires pains and care. It will not do simply to shut our eyes and be sure we are right. Neither logical reasoning nor the passive accumulation of any number of observations—which the ancients called experience—suffices to lay hold of them."

We know that dental anomalies seldom improve without treatment, and medical therapy without mechanical aid is generally inefficient. Preventive measures may abide in a clearer knowledge of endocrinology and infant nutrition, but the need of mechanotherapy will doubtless remain.

"The mechanical forces which are liberated by an appliance should be as delicate as possible, so that the effect upon the involved tissues is confined within biologic bounds. Extreme, severe forces produce tissue disturbances which may lead to root resorption, permanent loosening of the teeth and other pathologic lesions. Gottlieb and Orban, and A. Martin Schwarz have warned us that the forces should also be continuous, that intermittent cessation should be studiously avoided, if healthy response of the tissues is looked for with confidence." (Simon.)

Many authors have described appliances in detail and extolled such attributes as inconspicuousness, strength, delicacy and cleanliness, but the most important aid in the control of force is the development of a technic for measuring the acting forces at each application.

Heretofore, our sole reliance has been that of clinical experience, which the beginner finds difficult to acquire, and which is rarely decisive, or authoritative. During the last decade Irish, Bendias, Franzmeyer, Frevert and others have been experimenting in this phase of treatment and have devised instruments for measuring the forces applied in the mouth.

The optimum of capillary blood pressure should be the upper limit for the biologic optimal pace in orthodontic therapy, and recent research by Schwarz reveals that the activation for tipping movements in single rooted individual teeth is optimal when the dose is 20 grams.

Most beginners are bewildered by the great variety of the deviations found in anomalous dentures and the many technical methods devised for their correction. Procuring sufficient diagnostic data is the most important preliminary procedure of a successful treatment. The number of facts which must be gathered before a full understanding of a given anomaly is possible varies only slightly, but many practitioners continue to underestimate the fundamental importance of the diagnosis. After the latter has been concluded and mechano-therapy is found to be necessary, the design of the required appliances should be prepared.

In the past, we were content to provide measures for the movement of individual teeth and the attainment of arch form and arch relations. Perfecting efficient means for achieving these changes occupied our interest and skill for several decades. And when Angle insisted that we recognize all sagittal deviations of the dental arches and showed numerous cases which were corrected with intermaxillary anchorage, we were fully convinced that our difficulties were at an end.

But our methods for selecting distocclusions, for example, in which extraction of 4 | 4 seemed desirable, were very unreliable; e.g., we were unable to determine the presence of a total alveolar protrusion in the maxilla. In other instances of distocclusion in which we "believed" the mandible to be too short (although we could not demonstrate it) our attempts to "jump the bite" were not very successful. And so we drifted along in the hope that perfecting our appliances would some day solve our problems.

Deviations in the transverse width of the dental arches have been recognized for many years, and so-called narrowing of the maxillary arch has been corrected in various ways. Treatment for vertical deviations has also been provided since the need for effective measures to control the overbite was conclusively demonstrated. In fact, no one conversant with acceptable orthodontic technic has disputed the existence of modifications of width and height.

But anomalies of the underlying osseous structures which give rise to sagittal occlusal deviations have not been so widely accepted as their importance demands. This widespread indifference toward the recent refinements of diagnostic procedures has seriously retarded our progress. More effective methods

of treatment can only be devised if we improve our understanding of dental anomalies. In my opinion, the gnathophotostatic (cephalometric) methods of Simon provide a more reliable solution of our diagnostic difficulties than any of the means used previously.

(The writer showed several lantern slides which illustrated some of the facts described in the article.)

DISCUSSION

Dr. George Grieve, Toronto, Canada.—Dr. Lischer tells us that, according to some historians, the treatment of dental anomalies was practiced as early as the first century, and states that in the year 1878 the *Dental Cosmos* published a series of articles by the late Dr. Farrar, of New York, under the caption, "Regulation of Teeth Made Easy."

In the experience of many of us there were periods when it was felt that most of the difficulties had been solved. In 1907 Dr. Angle seemed to think that the ordinary expansion arch, at that time his sole appliance, was ideal. As an illustration of his opinion with regard to it he wrote upon his photographs, which he graciously presented to the members of the class at his school, the following: "In Art—in all things—the supreme principle is simplicity." He later, however, developed three other mechanisms each of which he believed to be an improvement.

In speaking of "standardized" appliances, Dr. Lischer calls attention to the alluring advertisements of mechanical laboratories in our dental journals, as well as by manufacturers of those appliances, which are misleading, to say the least, and that "the eradication of this traffic is a major obligation of this Society."

Dr. Lischer calls attention to the fact that our basic concepts have changed since the practice of orthodontia as a specialty began in 1896, and I am quite certain that we must go still farther before we reach that goal of perfection to which we aspire; the great pity is that we seem to be traveling so slowly. It seems difficult to arrive at any unanimity, and I am sure that all of us are earnest in our endeavor.

He says that a complete diagnosis is an "indispensable prerequisite." It is upon this diagnosis that many of us differ. Our mechanical mechanism has now become so perfected, thanks to Dr. Angle and others, that we have no great difficulty in accomplishing reasonably well what we start out to do, but in so far as we err in our analysis of our cases, just to that extent does our work fail.

Dr. Lischer cites some history upon the subject of extraction to facilitate orthodontic correction, and makes mention of a memorable debate between Dr. Case and Dr. Angle during the first decade of the present century. He says that in 1892 Dr. Angle recommended the extraction of the maxillary first premolars in cases belonging to his Class II, and that in 1895 Dr. Case followed the same procedure in similar cases. He says that in 1898 Dr. Angle expressed grave doubts as to the feasibility of this method, and by 1907 condemned it, although "Case, on the other hand, continued to apply this method to the end of his career, and eagerly sought for some guiding principles of diagnosis which would aid him in differentiating those anomalies in which extraction was advantageous." He says, also, that Drs. Case and Angle "labored valiantly and tried sincerely to analyze the nature of the problem," and mentions the introduction more recently of cephalometric methods by Simon which help to solve this problem.

At the time Dr. Angle resorted to the expedient of extraction of maxillary premolars he, apparently, did not use an appliance for bodily movement of teeth, although previous to this—in 1893—Dr. Case had introduced his "contour apparatus." This appliance was cumbersome but nevertheless efficient. By the use of the ordinary expansion arch it was not possible to place the maxillary incisors at a desirable angle after extraction of first premolars, although with Dr. Case's apparatus this was possible, but I feel that Dr. Case was inclined to leave the maxillary incisor roots too far forward to obtain the most esthetic facial contour, and consequently his results were very much criticized.

By the use of the efficient appliances we now have at our disposal it is possible to produce physiologic stimulation which will bring about a reconstruction of bone in the area surrounding the teeth so that the dental arches will conform to what we believe to be normal, *if* we know what is normal; this latter problem has been the one which has so often wrecked our orthodontic results. The common error, in my judgment, has been in our analysis as to the relation of the dental area to the cranium; we have not been carrying the maxillary teeth back far enough. We have failed to realize how much forward drift often takes place as a result of nature's unsuccessful effort to build (at the back) sufficient base to accommodate the tooth material. Dr. Angle, in one of his latest published papers, called attention to the possible forward displacement of teeth in both maxillae and mandible even in a Class II case. The work of Waugh and Price has demonstrated the fact that people who have not come within the scope of our civilization, such as the Esquimaux of the far north and natives of some remote sections of Switzerland, have well-developed jaws and no malocclusion.

To my mind it seems foolish that some still believe that in most cases all the teeth should be retained. Dr. Lischer says that the extraction of third molars has been widely adopted. I know that this is true, but I do not agree with this procedure, although in some cases it becomes absolutely necessary *unless* some other teeth farther forward are removed.

The main factor which we have to contend with in most cases of malocclusion is a forward drift of the teeth, and consequently our treatment, if we are going to be successful, consists in carrying the teeth back to their normal relation to the cranium. Where this is not possible we should have some removed, and the ones which will best facilitate our purpose are the first premolars. If we remove the third molars, with the idea that we shall carry all the other teeth back, then it is just too bad; for this cannot be done in most cases, unless our patients will wear occipital anchorage all the time, and they cannot do so. Some claim that this movement can be accomplished with the edgewise arch, and possibly other mechanisms, but here lies the crux of the problem, viz., that these men believe that the dental area occupies *normally* a position in relation to the cranium farther forward than some others of us believe to be its normal relation.

The essayist mentioned what he says might be termed "myofunctional therapy," and commended the work of Rogers along this line. Several other men have also added to our knowledge of muscle development, and I heartily agree that this is most important. A forward drift of the teeth is very often due to abnormal muscular pressure. Rogers recommends an exercise to obtain increased length of the mandible, but I feel that this can be accomplished more satisfactorily by mechanical means, and have described in some of my papers the technical procedure for obtaining this growth.

Dr. Lischer also spoke of clinical photography. We must arrive at a proper analysis of the relations of the dental apparatus to the face and the cranium if we are going to succeed in making a proper correction, and to do this accurate photographs are indispensable. He goes on to say that "most beginners are bewildered by the great variety of the deviations found in anomalous dentures and the many technical methods devised for their correction." Our treatment problem goes beyond the mere attainment of normal arch form and normal anteroposterior arch relations. It is the normal relation of the teeth to the apical base, and of the whole dental area to the cranium, which is the important factor.

It is in the so-called distocclusion cases (Class II Angle) that I feel we have been making our greatest error. Dr. Lischer says that we were formerly "unable to determine the presence of a total alveolar protection in the maxilla." This was due to our conception of what was the normal anteroposterior relation of the dental area to the cranium, as I mentioned earlier. Dr. Angle believed, and many still hold the same view, that in these cases the mandible is "distal in its relation to the maxilla and usually smaller than normal." While this is no doubt true in some instances, there are others of us who believe that in the majority of cases in Angle's Class II the mandible is normal and the abnormal axial relations are due to some degree of maxillary protrusion; Simon calls this "protraction" and classifies it as dental, alveolar and maxillary (or mandibular), which describes the various deviations clearly.

Dr. Lischer says that in cases with a short mandible "our attempts to 'jump the bite' were not very successful." For many years they were not, but by the use of the modification of Angle's "plane and spur" which I suggested many years ago, this is now a very successful procedure.

With reference to vertical deviations, mentioned by the essayist, I would say that the most potent causative factor in the production of an excessive overbite is the forward displacement of teeth, and would stress the importance of a proper correction of this condition when it presents. The September, 1933, issue of the *Journal of the American Dental Association* carries a report of a most interesting piece of research work done by Drs. Lischer and Orton, which I would advise all to read, and to note particularly their findings with reference to the overbite.

[Dr. Grieve showed a number of slides to bring out the points discussed by him.]

Dr. W. J. Speers, Boston.—On the last model which Dr. Lischer showed, he stated that lateral development there could only be obtained, if I understood him correctly, by the use of appliances which would bodily move the roots of those teeth. I think I will agree with him to this extent, that that type of treatment will produce the result more quickly.

I think I should also have to contend that lateral growth, even in those cases, can be obtained with a simple lingual wire plus utilization of muscle development, and I think I can show that in my clinic, where in six months' time 5 mm. of lateral development of the maxillary arch can be obtained by using only a mandibular lingual wire.

Dr. Hugo G. Tanzey, Kansas City, Mo.—From one point Dr. Lischer made, I have the feeling that to some extent he does not approve of some of the orthodontic treatment that is going the rounds, especially in the case he showed there, the casts and the photograph of a case which he stated was for the surgeon. My observations lead me to conclude that surgeons have not been much more successful with facial deformities than orthodontists have been with malocclusions. Looking at the picture of his cast, I thought I observed some little malocclusion. I do not know of any surgeon to whom I would refer that particular case to correct entirely by himself. I therefore bring that point out.

Dr. Grieve is doing wonderful orthodontic work, but I do not agree with him in his methods, and I do not agree with Dr. Lischer in his methods of diagnosis.

Dr. B. E. Lischer.—When Dr. Grieve says he has never found teeth to be posterior, he takes an extreme view. While his observations have been very extensive and although I know, personally, that he possesses a very fine diagnostic acumen, I still think his position is untenable. His conclusions are based only on observations and reasoning therefrom. These, as I said in my paper, are not adequate.

Somewhere, Lord Kelvin said: "If you cannot measure a thing you cannot explain it; you may have the beginning of knowledge, but you have not yet attained to a science." All sciences, today, are tending in that direction, and I am sure that orthodontists will not care to stand aside forever and say: "We know we are right."

In the past, our treatment results have not been put to a functional test; if we fulfilled esthetic demands, we were satisfied. In the future, we may have to adopt the three point contact tests employed in prosthetics for the reconstruction of denture mutilations.

I was glad to hear Dr. Speers say that bodily movement frequently follows after coronal tipping has been accomplished, especially if myofunctional therapy is used in conjunction with mechanotherapy. He spoke of 5 mm. expansions, but the case I showed presented an alveolar contraction of 1 cm.

I realize, as Dr. Tanzey pointed out, that some surgeons have not been successful in some of their operations on the jaws. Nevertheless, others, like Brühn, have done excellent work.

Dr. Brandhorst has just reminded me that the patient with an extreme total mandibular retraction, yet very mild dental malocclusion (shown on a slide), was very much improved by a surgeon, who transplanted a portion of her rib to the symphysis of her mandible. I recommended that at the time of her consultation.

STUDIES ON THE PHOSPHORUS AND CALCIUM CONTENT OF
VEGETATION AS AFFECTED BY SOIL AND CLIMATIC
CONDITIONS* †

HORACE J. HARPER, STILLWATER, OKLA.

IT MAY be difficult to establish a direct correlation between the composition of vegetation and the science of orthodontia. Consequently the only object of this discussion will be to present a few important facts which have been selected from a large amount of experimental research which may contain some valuable information. There is one question which should be asked at the beginning of this discussion: "Is it true that in dentistry as well as in agriculture the art of the profession has advanced more rapidly than the scientific phase?" In agriculture, crop production has been an important problem for several thousand years; whereas the technical development and the solution of many of the perplexing problems related to this subject have occurred during the past century.

In reading over the results of the remarkable progress in the field of medical science, I hesitate to present the very meager and almost elemental type of information which is available in the field of plant nutrition. It is quite possible, however, that the opportunities for certain phases of medical research are better than in plant studies, since the human race tends to preserve abnormal individuals; whereas in cultivated plants and domestic animals any indication toward weakness is eliminated as a result of careful selection and breeding of superior types. Even with all the careful selection which has been made, there are many indications of malnutrition, and food supply and rate of growth are two important factors which are responsible for this condition.

There is a ranchman living near Dewey, Oklahoma, who has seen the Oklahoma territory and Indian territory change from a vast prairie covered with some forest into a land with more intensive type of agriculture. He observed in the early days when there were no fences to restrict the movement of animals that cattle in grazing over the prairie would shun certain areas and graze where apparently for some reason or other the grass was more palatable or at least satisfied their hunger. He also noticed that cattle secured from certain parts of Texas to graze on Oklahoma grass land were quite variable in quality. The size and the general condition of cattle in certain areas were superior to similar types of animals which were produced in other counties on different kinds of soil.

In addition to the practical experience of ranchmen, research workers in foreign countries and also in certain parts of the United States have pointed out that superior types of animals have deteriorated rapidly and whole herds have

*From the Ageonomy Department, Oklahoma Agricultural and Mechanical College, Stillwater.

†Presented at the Thirty-Second Annual Meeting of the American Society of Orthodontists, Oklahoma City, November, 1933.

suffered severely from malnutrition when transferred from areas where normal growth was produced to certain other areas of land. In Australia, South Africa, New Zealand, and in Montana, Wyoming, Minnesota, and in other parts of the United States reports have been published indicating that something is wrong from the standpoint of the nutrition of farm animals. Either certain diseases have developed or bone structure has been retarded, producing animals of small stature and especially weak bones in milk cows, and abnormal development and even death in calves. Most of these nutritional problems have occurred on areas of poor soil. Good soil apparently has a favorable reaction on animal development; for example, in the blue grass region of Kentucky where the grass is rich in mineral content, the thoroughbred horse was developed. Also, fine cattle and sheep have originated on the limestone soils in England. The possible explanation of the more favorable development of animals produced on areas of fertile land may be found in the nature of the crops which are grown; although on certain areas of fertile land in arid regions vegetation may be deficient in phosphorus during periods of drouth.

Studies on the available plant food in Oklahoma soils indicate that in the eastern half of the state many soils are low in calcium and phosphorus. "Bone chewing" is frequently observed in herds of cattle when a ration is fed which does not contain some concentrated feed high in phosphorus. The addition of phosphate minerals and limestone to salt mixtures has been recommended in order to correct mineral deficiencies in the rations of animals. However, excessive use of minerals has produced harmful effects on the teeth of milk cows, and the presence of fluorine in phosphate minerals has also increased the growth of teeth; consequently attempts to correct a mineral deficiency in the ration of animals may produce undesirable results.

Although the present tendency is to stress vitamin deficiency in animal nutrition in relation to the process of calcification, the actual amount of research which has been conducted is somewhat limited. It would appear that in many instances, although vitamins are undoubtedly present in the feed, an adequate supply of mineral elements may be lacking or may be present in an unbalanced condition. Recent experiments have demonstrated that the addition of calcium to the diet of animals which were being fed on calcium deficient forage has resulted in the production of more rapid gains in weight; also the possibility of acid-base balance as a factor in normal bone development has received considerable attention, and conflicting results have been secured by different investigators. It is very interesting to note that many kinds of forage contain a considerable excess of acid ions. On the other hand, many plants contain a great excess of basic ions, and from the standpoint of animal nutrition there is no reason why the average farmer or ranchman cannot balance these particular elements in his feed. However, many cattlemen, because of lack of information concerning the laws which govern life processes, frequently depend upon feed which is low in ash, and consequently the animals suffer from malnutrition.

One of the most common errors in mineral deficiency in connection with farm animals occurs in feeding young live stock and hogs. Hogs frequently are fed a diet which is composed chiefly of grain. Grains, especially corn, are rel-

atively low in calcium; consequently any attempt to produce a very rapid growth may result in an inadequate bone development. In the production of cattle the same situation prevails, and at the Kansas Agricultural Experiment Station results have been secured which show that steers fed on ordinary fodder, produced from the harvesting of grain sorghums, supplemented with calcium carbonate, make more rapid gains than animals which receive no limestone in their diet. Also the addition of calcium carbonate to cane hay has increased the milk flow of dairy cows when this element was not being supplied in the more concentrated portion of the ration.

One of the most interesting phases of this whole problem, however, is that there is little evidence that the teeth of live stock suffer materially from a lack of calcium and phosphorus even though bone development may be abnormal. In some instances sheep from the western plains develop poor teeth; however, in most cases this is due to physical causes rather than to any lack of balance in the diet.

Some of the experiments which have been conducted with feeds at Michigan and Wisconsin have indicated that animals which are fed, for example, too much mineral may develop abnormal teeth. Rock phosphate, which contains some quantities of fluorine, over a long period of time has a tendency to develop soft teeth and stimulates the growth of the teeth in some instances so that they are abnormally long. Except in cases where the rock phosphate has been fed, the abnormal growth of teeth has not developed from other calcium salts, such as bone meal, ground limestone, precipitated calcium carbonate, calcium chloride, calcium lactate, and certain other phosphate salts.

In order to point out why a mineral deficiency does not occur in connection with the development of the teeth of animals but is of common occurrence in human beings, I should like to present some differences in composition of the different foods which are used in animal production as compared with some of the foods which are consumed by man. The human race in its gradual change from savagery to the type of civilization which exists at the present time has depended quite largely upon meat, cereals, and manufactured foods. In Table I, I have presented the average composition of forage which makes up much of the food used for animals. Although there is some variation in samples of vegetation secured from different soil types, the legumes are exceedingly high in calcium. The average composition of grass and straw is high in this particular element as compared with human food. A study of the phosphorus con-

TABLE I
CALCIUM AND PHOSPHORUS CONTENT OF FORAGE

CROP	CALCIUM PERCENTAGE	PHOSPHORUS PERCENTAGE
Alfalfa	1.642	0.153
Bermuda grass	1.272	0.227
Cowpea hay	1.833	0.165
Mungbean hay	1.521	0.120
Peanuts (vines)	1.889	0.065
Oat straw	0.223	0.051
Prairie hay	0.356	0.085
Sweet clover	1.275	0.125
Wheat straw	0.216	0.049

tent of legume crops and Bermuda grass will show that these crops are very high in phosphorus; while peanuts, prairie hay, and oat straw are low in this particular element.

In Table II data are given on the composition of certain vegetables, beef, hominy, oatmeal, and milk. It will be noted that with the exception of mustard and turnip leaves, these materials are relatively low in calcium, and with the exception of mustard leaves the phosphorus content of vegetables is not particularly high. Beef, hominy, oatmeal, and mustard are all high in phosphorus.

TABLE II
CALCIUM AND PHOSPHORUS CONTENT OF HUMAN FOOD

MATERIAL	CALCIUM PERCENTAGE	PHOSPHORUS PERCENTAGE
<i>Low Calcium—High Phosphorus</i>		
Beef	0.012	0.216
Hominy	0.011	0.144
Oatmeal	0.069	0.392
<i>High Calcium—High Phosphorus</i>		
Milk	0.120	0.093
Mustard	0.492	0.755
Turnip tops	0.347	0.049
<i>Low Calcium—Low Phosphorus</i>		
Apples	0.007	0.012
String beans	0.046	0.052
Cabbage	0.045	0.029
Carrots	0.056	0.046
Celery	0.078	0.037
Lettuce	0.043	0.042
Potato	0.014	0.058
Spinach	0.067	0.068
Turnips	0.064	0.046
Tomato	0.011	0.026

Table III gives some results on the composition of grains. In general the grains are relatively low in calcium and very high in phosphorus. This is also true of legume seed, such as beans and peas. It has been suggested by Forbes, of the Ohio Agricultural Experiment Station, that forage which is particularly low in plant food may be improved by fertilization of the soil. Studies at the Oklahoma Agricultural Experiment Station indicate that some changes occur as a result of fertilization; however, these changes are not nearly so pronounced as the variations which are found in different crops.

TABLE III
CALCIUM AND PHOSPHORUS CONTENT OF GRAINS AND FORAGE

MATERIAL	CALCIUM PERCENTAGE	PHOSPHORUS PERCENTAGE
Barley	0.043	0.400
Corn	0.020	0.283
Cottonseed meal	0.265	0.193
Cowpeas	0.100	0.456
Linseed meal	0.413	0.741
Wheat	0.045	0.423
Wheat bran	0.120	0.215

The effect of the addition of fertilizer on the composition of prairie hay increased the calcium content 0.08 per cent. The gain in alfalfa and sweet clover was 0.1 per cent, and no change in calcium content of the wheat kernel occurred

from the effect of fertilization. Grains, as a rule, are rather stable in composition, especially the embryo. Some changes take place in the endosperm, depending upon maturity. Fertilization may also increase the phosphorus content of plants, but as far as the total percentage of change occurs, the effect is small, and it is doubtful whether or not the effect of fertilization will overcome a mineral deficiency in a diet if some particular element should be lacking, with the possible exception of some of the rarer elements, such as iodine, unless some change was made in the food supply.

In certain parts of Oklahoma there are many soils which are exceedingly deficient in phosphorus and calcium; however, the average garden soil is not usually deficient in mineral plant food because of the fact that farm manures and other fertilizers are frequently applied; consequently the opportunities for mineral deficiency in vegetables are relatively rare since only the best vegetables are usually marketed, and high quality vegetables cannot be produced on poor soil.

There is one other phase of the problem of plant composition which also should be emphasized, and that is the effect of maturity and climate on the composition of crops. Studies on the composition of grass at the Oklahoma Agricultural Experiment Station have been conducted by Mr. H. A. Daniel for the past five years, and each year similar results are secured. The effect of seasonal variation on the calcium content of vegetation is interesting. This particular element remains relatively constant throughout the entire season; although some fluctuation occurs with periods of high and low rainfall. When the grass is small, no more calcium will be obtained than when the grass approaches maturity, since the plant continually absorbs calcium from the soil and builds it into its tissues. A very marked difference occurs, however, in case of nitrogen and phosphorus. When the plant is young, the nitrogen and phosphorus content is high, but as the plant approaches maturity the percentage of these two elements in the plant decreases rather rapidly. During periods of drouth the phosphorus content of grass frequently drops to a very low point apparently resulting from the chemical equilibrium between the relatively insoluble compounds in the soil and the moisture which surrounds the soil particles. Consequently during periods of drouth frequently animals which do not have high phosphorus reserve in their bodies suffer from phosphorus deficiency. During periods of excessive rainfall calcium deficiencies may occur, since analyses of crops indicate that a negative correlation occurs between the calcium and phosphorus content of prairie grass and alfalfa. It is a well-known fact that the animals can persist on a mineral deficient diet for a considerable period of time before any abnormal conditions develop, because of the mineral reserve in the animal body; however, where live stock are fed continually on mineral deficient forage, the ability of the animals to store minerals is greatly reduced, and when the reserve is exhausted abnormalities develop.

A careful study of the analyses of forage shows that the average calcium content is higher than that in human food. On the other hand, the phosphorus content of food consumed by live stock is relatively low; whereas the phosphorus content in human food is usually high. In view of the comparisons which can

be made from the studies which have been conducted, it seems that phosphorus deficiency in animals is more important than in man; whereas calcium deficiency is more liable to occur in the human race.

DISCUSSION

Dr. A. L. Walters, Tulsa.—The so-called "mineral salts" control, in a large measure, all the life processes of vegetable and animal life.

In order to produce vegetation, mineral salts must be constituents of the soil. Varying degrees of soil fertility are, primarily, dependent upon the amount of these salts supplied by the soil—rich, or fertile, soil, containing salts in abundance, while depleted, or infertile, soil, usually means a dearth or scarcity of these same salts.

Phosphorus is absolutely necessary in supplying plant life with the necessary elements for growth and development. Without phosphorus, other elements are valueless, even though present in great abundance—Mother Earth being unable to give her "all" unless phosphorus is present to lend invaluable assistance. Phosphorus reduction or absence means soil poverty with consequent loss of vegetable and animal vitality. Phosphorus is not found in soil in large quantities yet this limited amount (about 1/1000 part) is vital to maximum activation and utilization of all the other minerals.

Phosphorus is found in the tissue cells of all animals (in phosphorized protein form—nucleoprotein) while true phosphoproteins exist in egg yolk and casein. Phosphorized fats (lecithins), are found in brain and nerve substances. The germ cup of whole wheat, whole rice, whole oats, or barley, is filled with lecithins, while beans and peas contain them in abundance.

Less highly organized forms of phosphorus (found in all whole unrefined cereals and designated by chemists as phytates) are also taken up and utilized by the body.

Phosphorus is not a panacea, but an inadequate supply of phospho-compounds automatically brings about inadequacy of all the associated mineral compounds. Some years ago Sherman, Mettler and Sinclair made a report of phosphorus studies comprising twenty American groups, including the families of a Pittsburg lawyer, an Indiana teacher, a Chicago school superintendent, a New York teacher, a Tennessee students' club, 115 women students in Ohio, the families of a New York carpet dyer, sewing woman, a Pittsburg house decorator, a glass blower, mill worker, a Knoxville mechanic, a Connecticut farmer, Tennessee farmer and mechanic, two Alabama farmers, thirty Maine lumbermen and others.

The time consumed was fifty-eight days and the average obtained from 12,238 meals consumed by men and 793 consumed by women. Quoting: "These results indicate that present food habits lead to a deficiency of phosphorus, and it is not improbable that many cases of malnutrition are really due to an inadequate supply of phosphorous compounds."

Research has demonstrated 1.12 grams of food phosphorus daily, barely sufficient to maintain normal growth of a pig up to a weight of 85 pounds, after which that amount becomes inadequate.

"Nevertheless," says McCann, "what we can't do with respect to the food of growing hogs, without killing the hogs, we persist in doing with respect to the food of our growing children, regardless of the consequences."

Medical men of today are becoming familiar with the long, narrow, high-arched palate, the misformed, adenoid face, now so often seen among improperly nourished children. This lack of jaw and face may be attributed only in part to heredity, while a close student must also consider calcium phosphorus imbalance, and vitamins D and C starvation.

Clean milk, from a healthy cow (fed upon a balanced ration of foods grown upon fertile soil adequately supplied with essential mineral salts), supplemented with whole grain cereals (grown under the same adequate soil conditions) would do much in correcting this condition if expectant mothers and growing children could be induced to use them instead of the usual pasteurized milk, and breads made from refined flour or meal.

There is much evidence proving that none of the various phosphorous compounds of animal and vegetable foods may be successfully substituted for the compounds supplied by nature. Nature, on this score, seems to insist upon no substitute.

Dr. George W. Stiles, Bureau of Animal Industry, Denver.—The work I am doing in the Federal Service Station at Denver, in charge of the Bacterial and Pathologic Laboratory in the Bureau of Animal Industry, deals almost wholly with diseases incident to our domestic animal life.

It is only one of those interesting side studies which has developed through my efforts in recent years since this subject of mineral deficiency has been called to my attention.

There are a number of instances that, had I had time to get my wits together and think something of them specifically, might be of interest to you.

One I recall specifically is with reference to some cats. One of our local veterinarians in Denver used to send over specimens. Of course, they were dead at that time, or some of them were. Occasionally a victim would come over with some pampered animal which he was seriously considering making false teeth for, or having some inlaid gold work, or something of that sort. In this case it was what you might call a pampered cat, an apartment cat, not one of these cats that lives in an alley and has a chance to climb the fences and play with other cats, dig up the ground and come in contact with it, but one of those cats living on prepared foods.

I came to the conclusion that animals were suffering from mineral deficiency, because there was distinct evidence of caries and pathologic changes were taking place in the gums and tissues of those animals.

We have another instance (and I regret I did not pay more particular attention to the teeth in this particular case) where a man had a large variety of dog, a Newfoundland possibly, and the mother of that dog had been fed on skimmed milk and stale wheat bread for over a period of time. The puppies, some two or three months old, had one by one gradually died a slow, agonizing death, all but the last one and he came in with the history that he could hardly drag his hind parts. The long bones of that animal you could almost break with your fingers. A marked decalcification had taken place in the animal.

You could readily see what brought it about by a study of the diet.

Some years ago, a farmer east of Denver came in one day and told me, after a long, hard winter, that his cattle were down in the back. He said it was not hollow belly. He thought they were in good physical condition, but he had to tail them up.

After a study of the histology, the history of the case, and the history as concerned the minerals, I suggested the use of bone meal of a good grade, the odorless variety. A year later the man came in, and said, "I followed your advice and used the bone meal, and every animal that was down recovered, even the worst one. We had no more trouble."

Later, our soil chemists in the Agricultural College at Fort Collins, Colorado, studied this problem, as Dr. Harper has so ably outlined here, and they found that 75 per cent of the soil, from hundreds of analyses, was deficient in phosphorus. Many localities do have an ample amount of calcium. There may be an ample amount of calcium in one farm, or part of a farm, and another farm may be deficient in calcium or in phosphorus, or vice versa.

Dr. Hughes at Manhattan, Kansas, has been carrying on well-conducted experiments along these lines with young cattle. Some time ago he showed me his animals and experiments, and it was very remarkable.

I recall distinctly seeing two children, boys five or six years old, who had their mouths open, as most boys do. I happened to see little black pegs of teeth in their mouths.

When I saw the first boy, I asked the woman who was with him, "Madam, is that your child? Were you using rain water when this child was born?"

She looked at me in astonishment and said, "We lived in southern Kansas, in Coffeyville, and we had rain water two or three years before the child was born and two or three years afterward."

You men, as specialists along this line, should have seen the horrible condition of that child's mouth.

The other child lived in the mountains on a sheep range, and he may never have gotten to a competent dentist to look over his teeth. He had a similar condition, and those people, too, were using rain water. Lack of mineralization.

We cannot raise swine on rain water without posterior paralysis. I have seen whole

cement slabs in certain parts of Colorado eaten up by the hogs because they did not have enough mineral, whether lime or phosphorus, or both, I am unable to say. I have seen palisade board fences where the sheep had gnawed as high as they could reach.

As far as the work of the ordinary bacteriologist along this line, as I see it there is distinct evidence of mineral deficiency, lime, phosphorus, or both, in many of our soils. In some sections it is very, very low. In cattle where there is coming down of the horns, as Dr. Ketcham has possibly shown you elsewhere, we have the correlation of the soil deficient in the essential minerals.

We have the plant life essential under certain conditions of season, drought, and so on, and distribution. We find its effect on animals, and you men know what it does to human beings.

Dr. Heller, Stillwater.—I am not so much worried that we do not have dental caries among the animals. Still, I can see how our problems tie up with yours directly. Animals are more sensible than people, in the first place, and the farmers feed their hogs much better than women feed their babies. A farmer would not think of feeding his hogs a ration in which there were no minerals at all.

I was glad to hear what Dr. Walters said about eating the whole grain rather than the refined grain. In eating the whole grain, we get more calcium to make up for the lack of phosphorus. In osteoporosis in cattle, there is a phosphorus deficiency. In human dental caries I believe there is a calcium deficiency. Human beings tend to eat too little roughage and more concentrate, whereas animals eat too much roughage and too little concentrate. The animal gets more of the calcium along with the phosphorus, unless it goes into starvation periods. The human being, on the other hand, has nearly all the roughage removed from his diet. We have paresis in human beings and osteoporosis in animals.

There is a second factor also. The animal uses his teeth a great deal more, as Dr. Walters brought out. Also, in animals there is a greater range of the calcium content especially in the lactating cows which are called upon to give up so much of the calcium throughout the long lactating period. The result is that the leg bones are more liable to give out in cows than the teeth, which are more likely to develop at that time, and osteoporosis and not caries occurs in cows.

As we approach the animal kingdom with the type of food eaten by human beings, where we cage the animals, dental caries does develop in rats, cats and dogs.

I agree with Dr. Harper that there is a lack of calcium and of phosphorus in range cattle, and in human beings this is probably a lack of calcium. I think the fact of mineral metabolism can be stressed a great deal, as suggested by Dr. Stiles.

Dr. Horace J. Harper.—About the only comment I should like to make is to add a little to what Dr. Walters has said in regard to the composition of Oklahoma soils.

He said that ordinary soil might contain as much as 2,000 pounds of phosphorus per 2,000,000 pounds of soil. The average for Oklahoma is less than 600, so you can see we are in an area of rather low phosphorus soils.

It is rather interesting to note that in many areas the calcium and phosphorus deficiency is associated with an exceedingly low rate of growth. Under present conditions, the thing we are interested in is rapid development of animals. In many areas of Oklahoma it is noticeable that the live stock are very small, and the smallness is associated, as I pointed out in my original lecture, with a very low mineral content of the soil.

There are many soils in the blue grass region of Kentucky which contain as much as 20,000 pounds of total phosphorus per 2,000,000 pounds of soil. Consequently, conditions are more favorable for the larger intake of phosphorus under those conditions than they are in many of our soils here in Oklahoma.

It is interesting to note, however, that we can take some of these poor soils and by the addition of 100 or 200 pounds of plant food per acre produce a fairly good crop for one season. So that crop production is not limited by the fertility of the soil if that fertility can be added.

THE CRISIS IN ORTHODONTIA*†

PART I

2. TISSUE CHANGES DURING RETENTION. SKOGSBERG'S SEPTOTOMY

ALBIN OPPENHEIM, VIENNA, AUSTRIA

(Continued from page 466, April)

FOR my experiments I have preferred using the teeth of monkeys, because, as I pointed out in 1911,¹ their structure is very similar to that of human teeth, because the straight course of their roots guarantees direct transmission of orthodontic forces to the bone, and because of the analogous anatomic relations that exist between their teeth and the compact and spongy jaw bone and those of man.

Marshall² gives a similar reason for using monkeys for his experiments: "The teeth of macacus rhesus show certain similarities to the teeth of man not only in gross and microscopic anatomic features. . . ."

These same arguments influenced me also in the selection of the animals that were used to study tissue changes during retention. These findings which were reported briefly in 1913³ shall now be reported in a more extensive form.

The experiment included four teeth and leads through a number of stages of transformation and retrograde changes back almost to the original lamellous bony structure.

The following description of the retrograde changes in the bone during the period of retention starts out with the arrangement of the bone which is the result of gentle intermittent forces as described in the first chapter of this paper.‡ Just as in this previous report I am showing first a general view picture of each one of the moved deciduous teeth to illustrate the validity of findings in intact deciduous teeth; by illustrating a control tooth and by using a uniform magnification (25 times) for corresponding specimens, it is possible to study the retrograde transformation during the period of retention and the narrowing of the bone which had been widened during the period of active movement by a new formation of osteophytes.

This gradual narrowing and functional transformation of the bone can be plainly seen on teeth that have been retained rigidly as well as on teeth which have been subject to the full influence of function; however, we shall see that the extent of these changes depends largely upon the degree of functional stimulus. In immobilized, rigidly retained teeth the retrograde

*From the Department of Orthodontia of the Dental Institute of the University of Vienna.

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‡INTERNAT. J. ORTH. 19: 1206 (Fig. 6), 1933.

transformation is less extensive than in teeth that have been subject to functional stimulation. This process of transformation leads from the arrangement of the trabeculae parallel to the direction of force back to the arrangement parallel to the long axis of the tooth with lamellated structure of the bone and new Haversian canals.

These pictures are very instructive, since the changes during retention are governed by individual requirements and endogenous forces and not by any other influences or exogenous forces.

As I stated in the first chapter, each active influence exerted upon the bone by means of appliances produces only relative biologic changes. This has also been clearly recognized and laid down by Hellman:⁴ "It may be said



Fig. 1.

Fig. 2.

Fig. 1.—General view picture of mandibular incisor; magnification 8 times; *three months' retention*. Direction of movement indicated by arrow. At *a* and at the apex, shallow resorptions due perhaps to beginning shedding. *C*, cementum; *P*, periodontal membrane; *Rp*, shallow resorption on the lingual side; *ZK*, germ of permanent tooth.

Fig. 2.—General view picture of mandibular incisor, magnified 8 times; *six months' functional stimulation*. No evidence of shedding; direction of movement indicated by arrow. *C*, cementum; *A*, osteoid bone, arranged in the direction of pull; *Kn*, almost normal alveolar wall; *ZK*, germ of permanent tooth.

that 'physiological treatment' can under no circumstances be construed to mean any sort of mechanical procedure, regardless of what type of orthodontic appliance is used, and how well it is manipulated and controlled."

For retention these considerations can be disregarded; it is in our power to reduce the possible damages during the retrograde process of transformation to the possible minimum by a proper choice of the appliances used.

The pictures of the four different stages of retention were taken from the almost intact deciduous incisors of a monkey (baboon); two of these

teeth show minute resorptions which, however, have no relation to the experiment, since they are found in areas that are not subject to pressure. All teeth were subjected to the same treatment; they illustrate the transformation process during the period of retention after three and six months respectively of rigid fixation, as well as the condition after three and six months respectively of full functional stimulation.

The treatment (labial movement) was carried out with Angle arch wire and ligatures, using gentle, elastic, intermittent forces which were renewed every fifth day. After forty days, that is, after the force had been renewed seven times, the experiment was discontinued; two of the moved teeth were retained by means of a band and two spurs resting against the neighboring

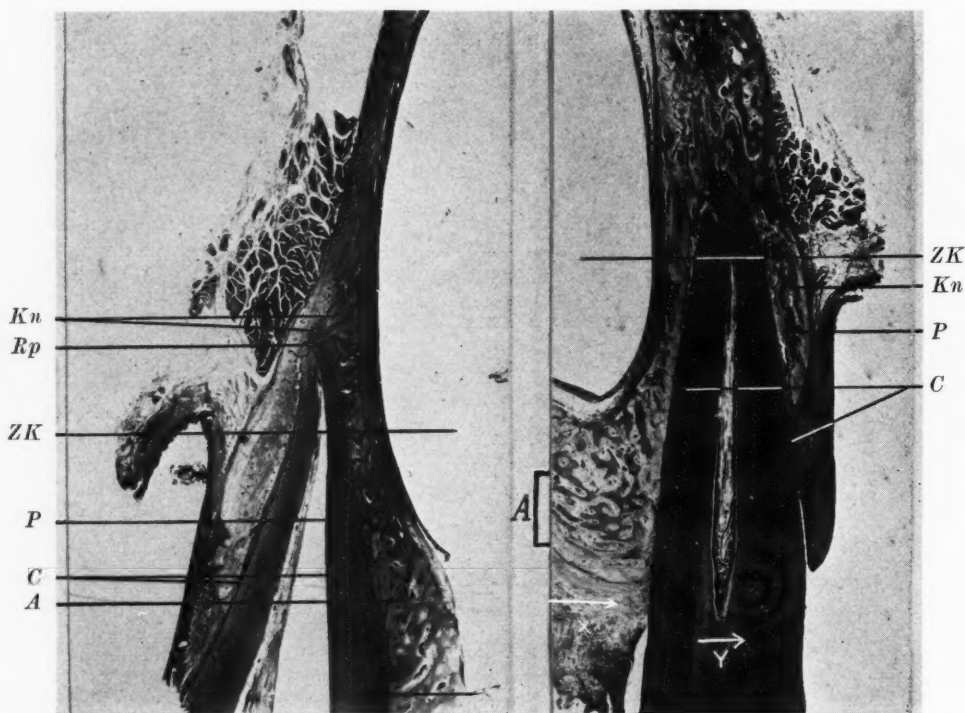


Fig. 3.

Fig. 4.

Fig. 3.—General view picture of maxillary incisor magnified 8 times; direction of force indicated by arrow (Y); *six months' functional stimulation*. Rp, root resorption, not shedding; C, cementum; P, periodontal membrane; Kn, new formation of bone; ZK, germ of permanent tooth.

Fig. 4.—General view picture of maxillary incisor magnified 8 times; direction of force indicated by arrow; almost no evidence of shedding; *six months' retention*. Kn, transitional bone; C, cementum; P, periodontal membrane; ZK, germ of permanent tooth.

teeth; two were left without retention so that they returned within a few days to their original position and were subject to full function. The animals were killed after three and six months respectively.

In Fig. 1 we see a general view picture of a mandibular incisor that had been rigidly retained for three months after having been moved labially in the direction indicated by the arrow. At the apex we find minute changes indicative of the beginning process of shedding (a); the lingual side is entirely free from resorptions except for one small area (Rp) for which I have no

explanation; otherwise the cementum is completely intact, particularly in the upper two-thirds of the labial side of pressure (see Fig. 5); thus it is evident that the cementum has not been damaged despite the intermittent force and despite the formation of osteoid during the intermissions. In the apical area we find no evidence whatever of a deviation of the apex in the direction opposite to the movement of the crown; the tipping took place in such a way that the apex acted as a fulcrum (see my previous discussion concerning the suggested dangers of osteoid and the fulcrum in the first chapter*). In Fig. 5 we see the marginal portion of the labial side of pressure in Fig. 1 (magnification 25 times); the bone is wide, and in some areas the perpendicular arrangement of the spicules in the direction of force can still

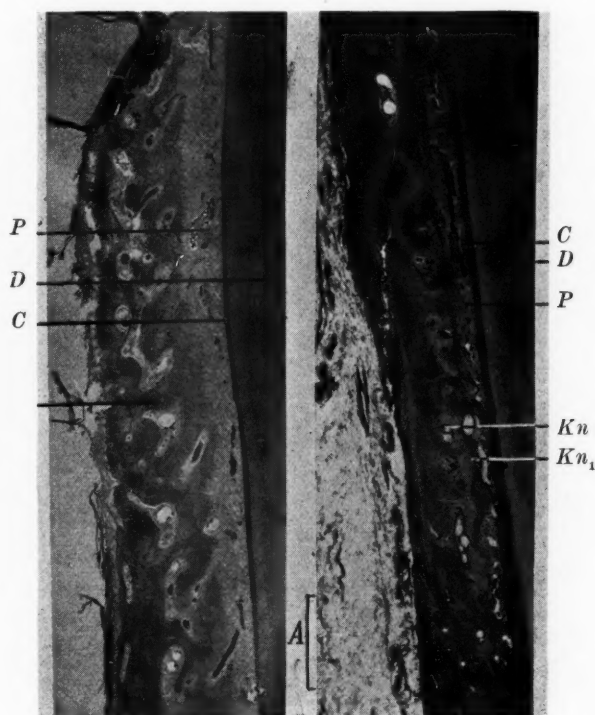


Fig. 5.

Fig. 6.

Fig. 5.—Marginal portion of the labial side of pressure of tooth shown in Fig. 1, magnified 25 times. Direction of force indicated by arrow; *three months' retention*. C, cementum; D, dentine; P, periodontal membrane; Kn, bone still partly arranged in the direction of force.

Fig. 6.—Marginal portion of the labial side of pressure of tooth shown in Fig. 2, magnified 25 times; direction of force indicated by arrow; *six months' functional stimulation*. C, cementum; D, dentine; P, periodontal membrane; Kn, transitional bone; Kn₁, osteoid bone. Almost normal lamellous bone structure.

be recognized. The difference in staining between old and new bone is not especially evident in this specimen.

I wish to call the new bone which during active orthodontic treatment replaces the original compact bone and is arranged in the direction dictated by the orthodontic appliance *transitional bone*. In the specimens of retention this transitional bone now represents the "old bone" as compared to the bone which has been newly formed during the period of retention.

*INTERNAT. J. ORTH. 19: pp. 1208 and 1211, 1933.

On the lingual side of pull (Fig. 9, a marginal portion of Fig. 1, magnified 25 times) we see at *Rp* the already mentioned resorption which must be of recent origin, probably formed during the period of retention, because there is not yet evidence of repair. On the other hand, it is no longer in the active stage, since there are no osteoclasts present. The phenomenon which has already been described in the first chapter, namely the excessive formation of osteoid with resulting narrowing of the periodontal space, may also be seen in this specimen in some areas. The purpose of this formation is to hold the teeth firmly together and keep them free from pain. In one area the individual processes of osteoid have already become fused to form a new continuous alveolar wall (Fig. 9 f).

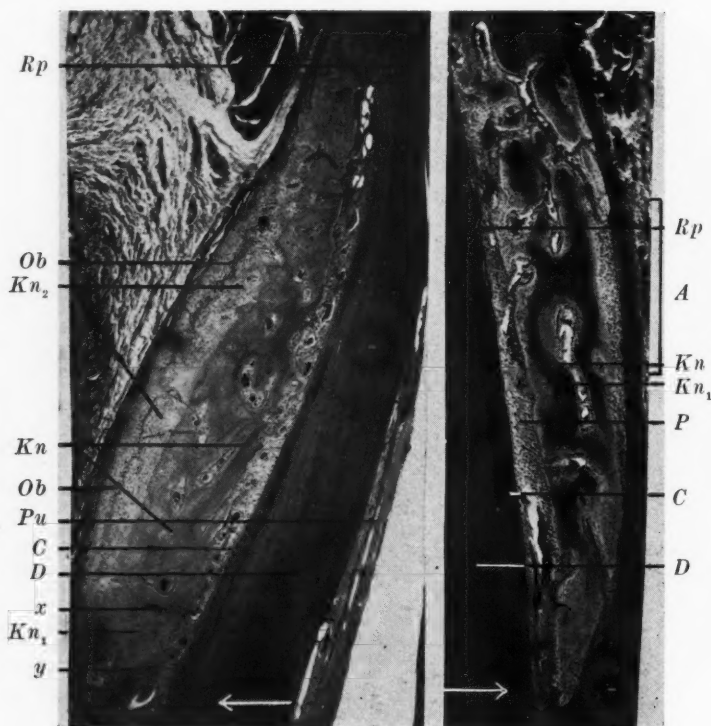


Fig. 7.

Fig. 8.

Fig. 7.—Labial side of pressure of tooth shown in Fig. 3; magnification 25 times; direction of force indicated by arrow; *three months' functional stimulation*. *C*, cementum; *D*, dentine; *Rp*, root resorption; *Kn*, transitional bone; *Kn₁*, osteoid bone; *Kn₂*, rachitic bone (?); *Ob*, osteoblasts; *Pu*, pulp.

Fig. 8.—Labial side of pressure of tooth shown in Fig. 4, magnified 25 times; direction of force indicated by arrow; *six months' retention*. *Rp*, shallow resorption of cementum; *Kn*, transitional bone; *Kn₁*, osteoid bone; *C*, cementum; *D*, dentine; *P*, periodontal membrane.

In Fig. 3 we see a general view of a maxillary incisor that has been moved toward the labial side in the direction indicated by the arrow. This tooth has not been retained and was fully exposed to functional stimuli. The extensive resorption of the apex has in all probability nothing to do with the possible process of shedding and shall be discussed in the subsequent paragraphs. The cementum, which is much thicker on the labial than on the lingual side, is also absolutely intact on the labial side of pressure; no damage has been caused by the osteoid formed during the intermissions (see also Fig. 7).

Fig. 7 illustrates the labial side of pressure in Fig. 3, magnified 25 times. Contrary to the findings in the rigidly retained tooth shown in Fig. 5, there is no more evidence of the previous perpendicular arrangement of the spicules; the entire labial plate of bone is thinner, the transitional bone (*Kn*), which can be plainly recognized by the darker staining, is for the most part arranged parallel to the surface of the tooth except for two spicules near the alveolar margin (*x, y*). This area is reproduced in Fig. 14 in a magnification of 100 times and shows the solid fusion of the transitional bone by osteoid bone which has been newly formed during the period of retention. This extensive formation of osteoid bone along the entire labial wall has not been observed in any other specimen of retention; it may be assumed that this excessive formation

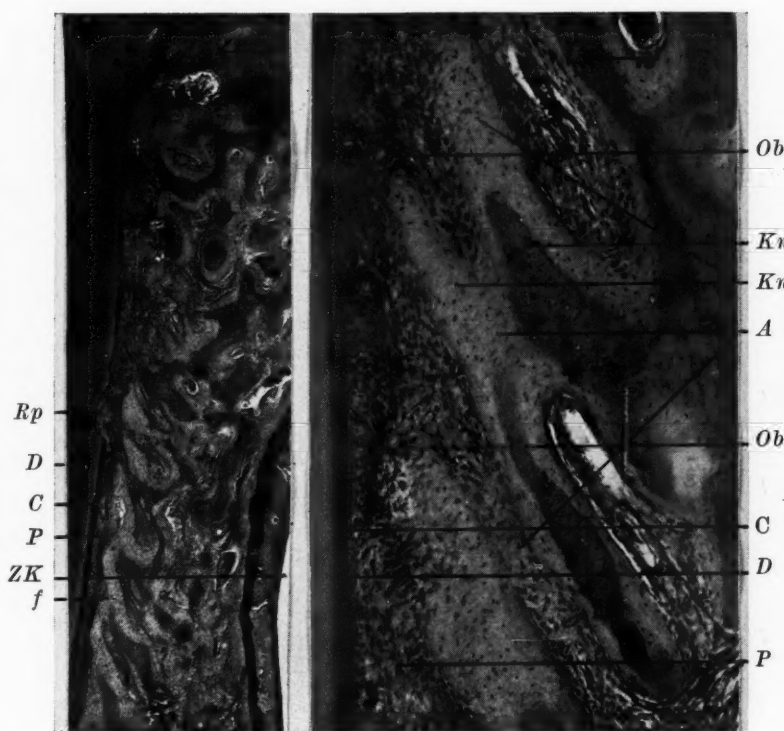


Fig. 9.

Fig. 10.

Fig. 9.—Marginal portion of the lingual side of pull of tooth shown in Fig. 1, magnified 25 times; direction of force indicated by arrow; *three months' retention*. *C*, cementum; *D*, dentine; *P*, periodontal membrane; *Rp*, resorption of cementum; *f*, fusion of neighboring processes of osteoid; *ZK*, germ of permanent tooth.

Fig. 10.—Area *A* of Fig. 2, magnified 100 times; direction of movement indicated by arrow; *six months' functional stimulation*. *C*, cementum; *D*, dentine; *P*, periodontal membrane; *Kn*, transitional bone; *Kn₁*, osteoid bone surrounded by a dense layer of osteoblasts; *Ob*, narrowing the periodontal space; *A*, fusion of osteoid bone of two adjacent trabeculae.

of osteoid may be due to rickets, caused by captivity. The cementum surface is intact except for some very small, fully repaired defects of the kind which can be found in every normal specimen.

On the lingual side of pull (Fig. 3) one can, on the whole, still recognize the arrangement of the spicules parallel to the direction of pull; the excessive formation of osteoids has taken place to such an extent that the periodontal space is almost closed (directly above the arrow in Fig. 3). Along almost the

entire lingual side the fusion of the osteoid into a new, continuous, inner alveolar wall may be recognized. In Fig. 11, illustrating the area *A* in Fig. 3 magnified 100 times, the beginning union of the osteoid becomes wider and more calcified until it creates a solid junction similar to the one that could be found on the labial side in an advanced stage (see Fig. 14).

Fig. 13 is a higher magnification (100 times) of the apex in Fig. 3. This evidence of resorption, which is strictly confined to the apex and characterized by a large number of osteoclasts, suggests, in conformity with the findings of Gubler⁵ which are very similar to my own, that we are here dealing not with the normal process of shedding but with a genuine root resorption (Ketcham⁶). The apex is surrounded by a solid plate of bone (Fig. 13 *K*).

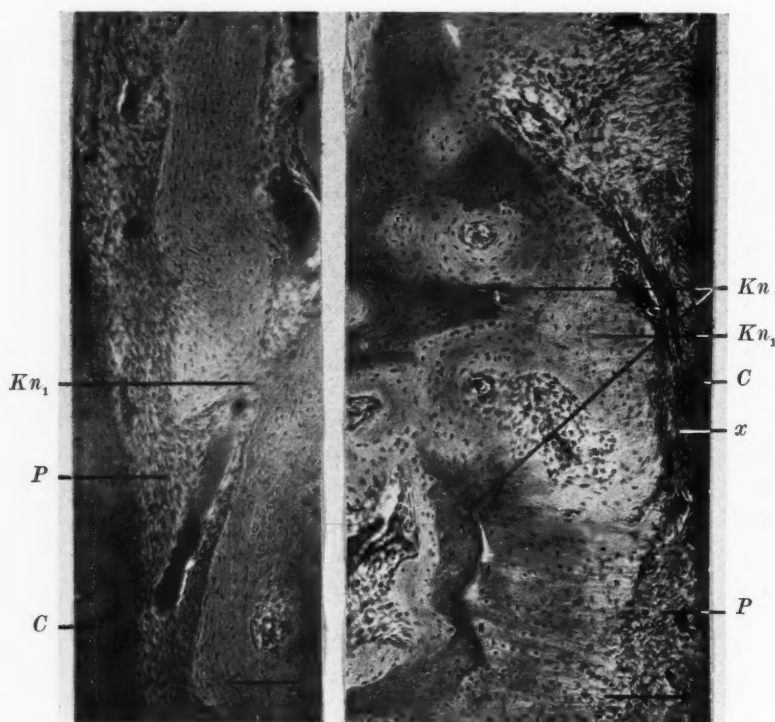


Fig. 11.

Fig. 12.

Fig. 11.—Area *A* of Fig. 3, magnified 100 times; direction of force indicated by arrow; *three months' functional stimulation*. *C*, cementum; *P*, periodontal membrane; *Kn*, fusion of the osteoid of two neighboring trabeculae of bone.

Fig. 12.—Area *A* of Fig. 4, lingual side of pull, magnified 80 times; direction of force indicated by arrow; *six months' retention*. *Kn*, transitional bone; *Kn*, osteoid bone; *C*, cementum; *P*, periodontal membrane; *x*, marked narrowing of the periodontal membrane.

This bone shows on its inner surface evidence of new formation as a compensation for the loss of dental structure (Fig. 3 *Kn*, and Fig. 13 *Kn*). We shall refer to this specimen when dealing with the problem of root resorption.

Häupl⁷ has discussed in his paper "Paradentitis profunda" the problem of resorption of cementum from various view points; however, I found no necessity to refer to these findings and discussions when dealing with the problem of genuine root resorption, because they have nothing to do with the shortening of the apex as described by Ketcham. The common resorp-

tions on the lateral portions of the teeth and occasionally at the apex have a well-known etiology, whereas the etiology of genuine root resorption with its characteristic radiographic and histologic picture is still quite mysterious. A. M. Schwarz tried to explain the etiologic factor for genuine root resorption by the knowledge obtained from the experiments of Gottlieb and Orban on excessive stress, and set down his ideas as established facts, although they are mere theories and do not change the fact that the etiology of genuine root resorption is still as mysterious as before, and that genuine root resorption and occasional resorption of the cementum are two entirely different manifestations. I shall discuss this problem later in more detail.

In Fig. 4 we see the general view picture of an intact maxillary deciduous incisor that had been moved labially in the direction of the arrow. The tooth

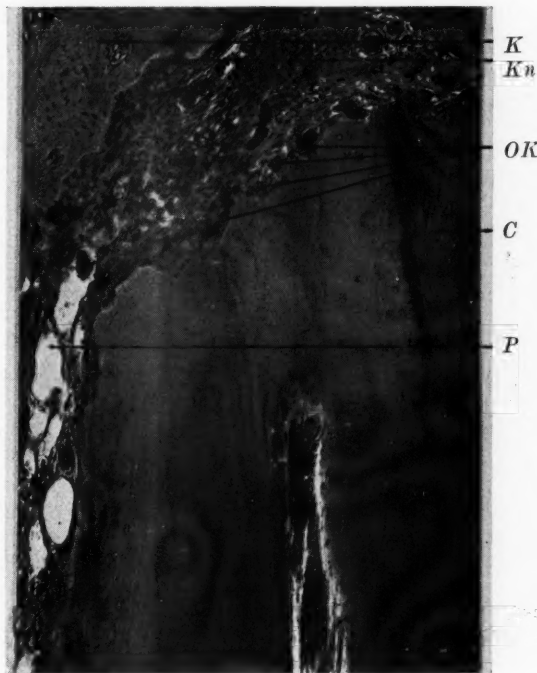


Fig. 13.—Apex of tooth shown in Fig. 3, magnified 100 times. *OK*, osteoclasts; *K*, solid bone; *Kn*, new bone; *C*, cementum; *P*, periodontal membrane.

shows no evidence of beginning shedding. It had been retained rigidly in its labial position for six months. The cementum of the root is absolutely intact in the marginal portion which during the labial movement had been subjected to pressure; no damage has been caused by the osteoid which had been formed during the intermissions (see also Fig. 8, magnification 25 times). Only the upper apical fourth of the labial cementum shows very shallow resorptions of the cementum, which, however, are not located in the area of pressure (Fig. 8 *Rp*).

In Fig. 8 we see the labial side of pressure of Fig. 4 in a magnification of 25 times. In some areas the perpendicular arrangement of the transitional bone (*Kn*, stained dark) can still be recognized. However, most of the transitional bone is arranged parallel to the surface of the tooth and is

completely surrounded by the bone which has been newly formed during the period of retention (Kn_1 , light stain). The difference between the two types of bone, namely, the transitional bone and the newly formed bone of the period of retention, is very pronounced; there has been no assimilation of these two forms of bone, and they can be distinguished clearly in Fig. 15, a higher magnification of the Area A in Fig. 8 (Fig. 15).

On the lingual side of pull (Fig. 12, area A of Fig. 4 magnified 80 times) of this tooth, the direction of pull can still be recognized in some of the spicules despite six months of retention. The new formation of osteoid around the transitional bone is very marked and has in some areas caused a considerable narrowing of the periodontal space. But we still find in many areas defects in the plate of osteoid bone which forms the new inner alveolar wall, whereas

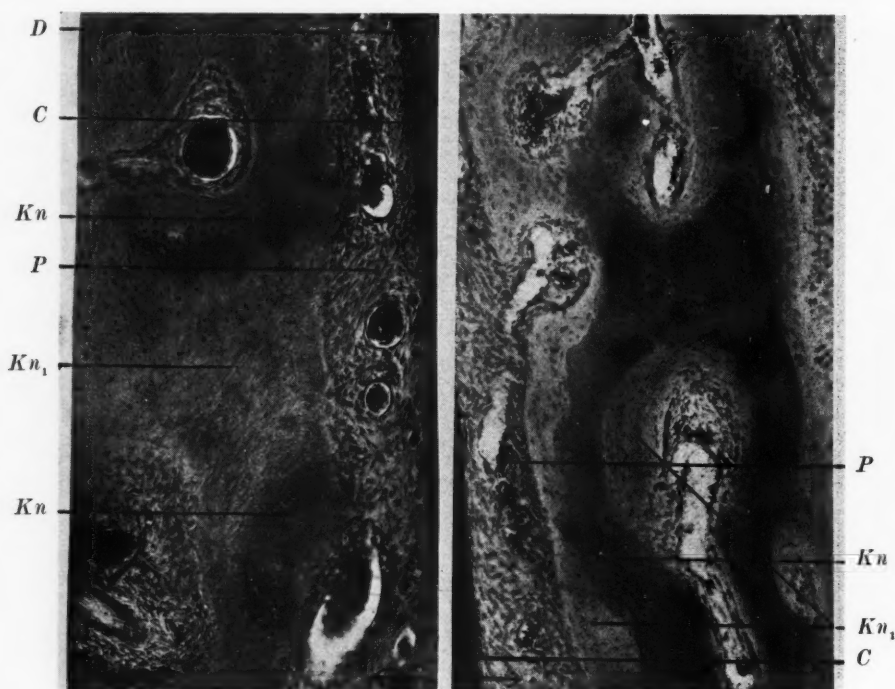


Fig. 14.

Fig. 15.

Fig. 14.—Area *xy* from Fig. 7, magnified 100 times; *three months' functional stimulation*. Solid fusion of the transitional bone (Kn) by osteoid (Kn_1). *C*, cementum; *D*, dentine; *P*, periodontal membrane; direction of force indicated by arrow.

Fig. 15.—Area A of Fig. 8, magnified 80 times. Direction of force indicated by arrow; *six months' retention*. *C*, cementum; *P*, periodontal membrane; Kn , transitional bone; Kn_1 , osteoid bone. Notice the marked difference between transitional bone, Kn , and newly formed bone, Kn_1 .

in the specimens showing the result of three months of functional stimulation (Figs. 3 and 11) this regeneration of the alveolar wall is almost completed.

In Fig. 2 we see a general view picture of an intact mandibular deciduous incisor which had been moved labially in the direction of the arrow. This tooth shows no evidence of beginning shedding. It had been released after forty days of active orthodontic treatment and was then subjected to full functional stimulation for six months. The cementum (*C*) is also completely intact on the labial side of pressure (Figs. 2 and 6); it has not been damaged by the osteoid which was formed during the intermissions.

Just as in the other specimens there are no changes in the apical region which would indicate or suggest any excursion of the apex during the period of active treatment; even though six months have passed since the orthodontic treatment, we should still be able to find evidence of repaired Howship's lacunae in the bone if such an excursion had taken place. *This not being the case, the assumption seems justified that the fulcrum was located at the apex.*

In Fig. 6 we see the marginal portion of the labial side of pressure of Fig. 2 in a magnification of 25 times. During the six months of full functional stimulation the thickness of the bone had been reduced to nearly one-half as compared with Fig. 5 (three months of rigid fixation). The functional struc-

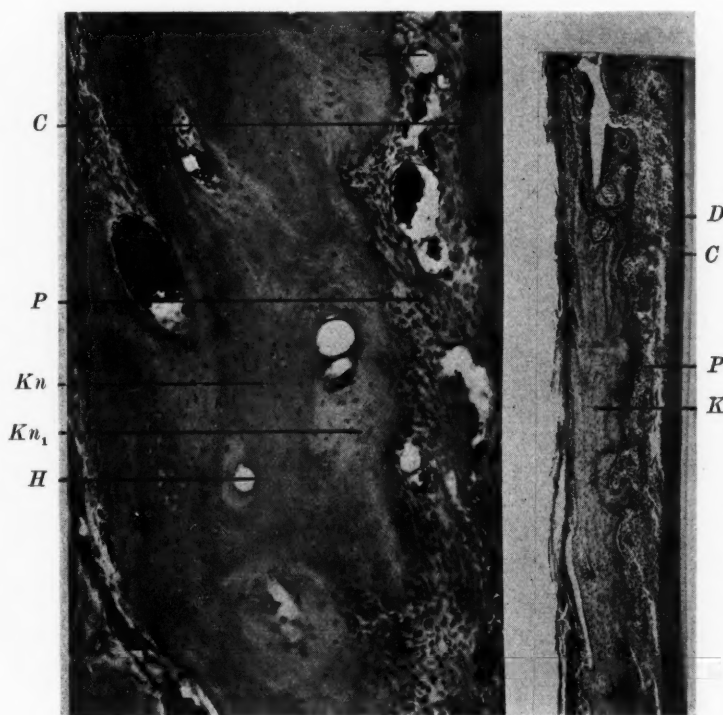


Fig. 16.

Fig. 17.

Fig. 16.—Area A of Fig. 6, magnified 100 times. Direction of force indicated by arrow; *six months' functional stimulation*. The difference between transitional and new bone which was clearly visible in Fig. 15 cannot be recognized here. C, cementum; P, periodontal membrane; Kn, transitional bone; Kn₁, osteoid bone; H, Haversian system.

Fig. 17.—Control tooth, mandibular incisor; labial bone plate showing lamellated structure. Magnification 25 times. C, cementum; D, dentine; P, periodontal membrane; K, bone.

ture of the bone is much more marked in comparison to that shown in Fig. 7 (three months of full functional stimulation). The labial plate of bone also appears of much more consolidated structure if compared with Fig. 8 (six months of rigid retention); it shows almost normal lamellous structure and formation of new Haversian systems (Fig. 16, area A of Fig. 6 magnified 100 times). The distinct difference between transitional and newly formed bone which could be seen in Fig. 8 (six months of rigid retention) has nearly disappeared; there is no longer any difference between the staining of the two types of bone; their assimilation is almost complete, and, as can be seen in

Fig. 16 (six months not retained) in contrast to Fig. 15 (six months of rigid retention), the transition of one kind of bone into the other is much more gradual. Still, even six months of full functional stimulation have not been sufficient to destroy this last remnant of differentiation.

On the lingual side of pull of the specimen (Fig. 2, right side, and Fig. 10, area *A* of Fig. 2 magnified 100 times) the retrograde changes are relatively not so far advanced as those on the labial side; especially near the alveolar margin the first four spicules of bone are still arranged in the direction of pull and are not yet fused into one compact new alveolar wall (Fig. 2) but are only, as can be seen in Fig. 10 *A*, united by narrow bridges of osteoid tissue. The periodontal space is narrowed by excessive formation of osteoid;

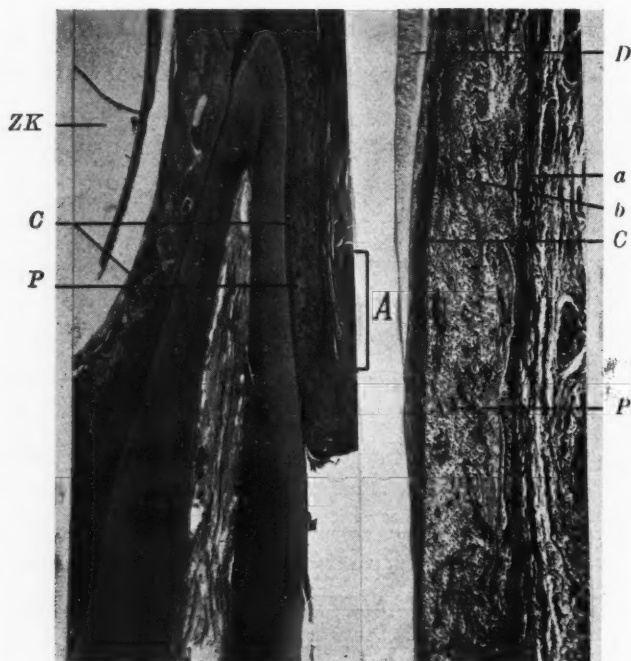


Fig. 18.

Fig. 19.

Fig. 18.—General view of control tooth, maxillary deciduous incisor; no evidence of shedding. Magnification 10 times. *C*, cementum; *P*, periodontal membrane; *ZK*, germ of permanent tooth.

Fig. 19.—Area *A* of Fig. 18. Magnification 25 times. *C*, cementum; *D*, dentine; *P*, periodontal membrane.

below these four spicules of bone the newly formed osteoid forms a continuous alveolar wall with only occasional breaks.

In order to give additional information about the extent of the retrograde changes and about the reduction in the thickness of the bone, the corresponding areas of the normal control teeth (maxillary and mandibular incisors) are also reproduced in a magnification of 25 times.

In Fig. 17 we see the labial wall of the control tooth, a mandibular incisor, which has been shown in the first chapter.* The difference in the width of the labial wall of bone between Fig. 5 (three months of retention) and Fig. 6

*INTERNAT. J. ORTH. 19: 1203 (Fig. 1), 1933.

(six months not retained), on the one hand, and the labial wall of bone of a mandibular control incisor (Fig. 17), on the other hand, without any additional comment gives a correct idea of the retrograde changes which have taken place. Fig. 6 (six months' full functional stimulation) more closely resembles the normal condition shown in Fig. 17, as far as the width of the bone is concerned.

Fig. 18 shows a general view picture of a maxillary incisor which has been used as the control tooth for the lingual movement shown in the first chapter.* This illustration may serve as additional proof of the intactness of the deciduous teeth used in these experiments. There is no evidence of beginning shedding; the cementum is absolutely intact.

Fig. 19 shows area *A* near the alveolar margin of Fig. 18 magnified 25 times. Here the compact bony wall is not so markedly developed as in the mandible (Fig. 17). The labial bony wall of this tooth (Fig. 8) that had been rigidly retained for six months is still considerably wider than the corresponding area in the control tooth (Fig. 19). The area between points *a* and *b* in Fig. 19 may be considered as the normal thickness of the labial alveolar wall.

In these specimens all the basic rules and principles of general bone histology and bone pathology are applied to orthodontia for the first time.

In summarizing these histologic findings it can be said that:

1. *The transformation of bone during active orthodontic movement as well as during the period of retention is performed by the activity of bone cells exclusively; this process is by no means a "compensation for a 'difference in the tension' caused by the moving of the teeth" (Walkhoff,⁸ Skogsborg⁹).*

2. *There is a retrograde process during the period of retention, the progress of which depends upon the time which elapses and upon whether or not the tooth is retained.*

3. *This retrograde process occurs more slowly in rigidly retained teeth in which the functional stimuli cannot act to their full extent; hence in these cases the period of retention has to be extended.*

4. *This natural retrograde process cannot be improved or stimulated by artificial scar formation (such as Skogsborg's septotomy).*

5. *In the teeth of monkeys six months of full functional stimulation are not sufficient to bring back the original normal condition.*

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(To be continued.)

POSTEROCLUSION*

HUGH GRUN TANZEY, D.D.S., KANSAS CITY, MO.

THERE would seem to be no reasonable excuse for reporting a case on this topic, other than to offer cumulative testimony to the expressed opinion that we are prone to exact too frequent brief visits of our patients, and to conclude the corrective treatment too early.

A small percentage of our patients are requested to return for treatment earlier than in two weeks. A larger number are permitted to return in six weeks. Some residing at a distance are allowed to remain away from eight to ten weeks. The younger children, five to eight years of age, can usually go from four to six weeks. I believe that during the early periods of treatment for the younger patients and the convalescent period for most cases, it is not advisable to see the patient oftener than once a month. I do believe that near the conclusion of corrective treatment for adults, we are sometimes justified in requiring quite frequent visits.

It is reasonable to assume that a child's time is as valuable as that of the operator, and when it is necessary to travel a considerable distance, we should observe extreme precaution in the treatment and return visit requirements. I believe that the majority of experienced orthodontists will agree with this opinion, and yet all of us are seeing patients too often.

Some of the less experienced orthodontists may be excused for an unnecessary anxiety about their patients, but for those orthodontists (if there be any left) who deliberately require frequent visits in order to create a more impressive reception room atmosphere or to bolster the theory that they are earning a stipulated monthly fee, I am not prepared to prescribe.

January 18, 1926, patient presented with a typical case of malocclusion involving a bilateral posterior relation of the mandible; decided narrowing of the maxillary arches and pronounced protrusion, separation, and elongation of the anterior maxillary teeth. A lad ten years of age, in fourth grade at school—residing 175 miles away. (Fig. 1.)

Weight: Ninety-seven pounds.

Oral Health: Good; small cavities and small alloy fillings in deciduous molars with slight indication of caries in occlusal fissures of permanent molars served as a significant warning.

Present General Health: Reported "splendid."

Early Childhood: Frail first two years. Persisting abscess above central incisors at about the age of five or six years was reported.

Family History: Only child, both parents have malocclusion, the mother's being a similar type, the father's irregular but not similar.

*Presented at the Thirty-Second Annual Meeting of the American Society of Orthodontists, Oklahoma City, Okla., Nov. 8-10, 1933.

Nasal Passage: Apparently some obstruction. Turbinates rather large. Tonsils and adenoids carefully removed two years previously.

Habits: Mouth-breathing (the mother reports not); obviously the child sleeps with lips open.

Fig. 1.



Fig. 2.

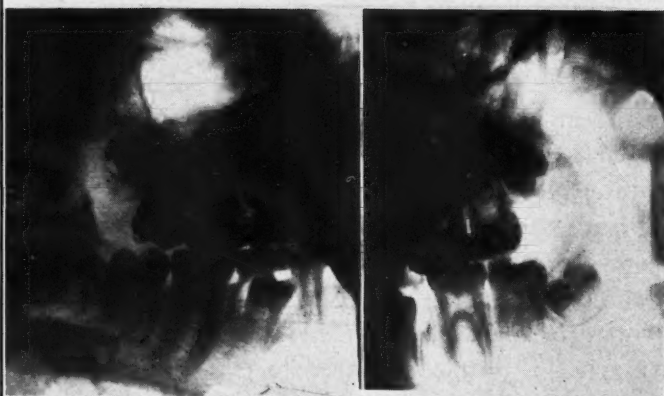


Fig. 3.



Fig. 1.—Bilateral posteroclusion.

Fig. 2.—X-ray photographs showing arch relation.

Fig. 3.—Photographs of patient showing pronounced distortion of maxillary teeth.

A brief analysis of the findings seemed to justify an estimate of time approximating three years to treat this case, two years for rearranging teeth and arch relationship and one year for postoperative maintenance. As usual no

provision was made for subsequent treatment in case of relapse (which in this case happily did not occur).

Impressions were taken with modelling compound. Pinch band measurements of maxillary right and left first permanent molars and lateral incisors were procured, the bands constructed and cemented in position, and the patient was referred to radiodontist and to photographer, customary routine. (This all transpired, including consultation, at the first sitting.) (Figs, 1, 2, and 3.)

The following day appliances were completed and adjusted to teeth in both arches. Above was a platinum paladium retraction arch 0.028 with 0.025 loop spring stops. This arch engaged latches on the lateral bands. Wire ligatures were placed around the second deciduous molars engaging lingual bars and labial arch, the latter being adapted to secure expansion all around and to permit the central incisors to move lingually. The mandibular molar bands, with lingual bars extending back to engage the second molars and forward lapping at the median line, were cemented, and an 0.028 arch wire was adjusted nearly ideal in shape to expand all around. Small figure-eight ligatures were placed around the lateral incisors and larger wire ligatures placed around the first premolars all engaging the labial arch and lingual bars. He was instructed to return the following day for observation; he was told to keep his teeth clean, and to start using large intermaxillary elastics in two weeks. Time consumed up to this date was six hours in the chair and six hours of laboratory work.

February 14 (26 days later). He returned unexpectedly on Sunday; both mandibular anchor bands were loose and the labial arch was badly distorted. This sitting required two hours.

May 24 (98 days later). He returned at this time. A lower right lateral spur band was constructed and cemented to place. Both labial arches were removed and readjusted for all around expansion and continuous use of medium intermaxillary elastics was ordered. (Four hours.)

Following this visit he made a trip north for the summer, and returned August 30 (98 days later). At this time both labial arches were removed and readapted. A spur band was placed on the lower left lateral, a lacing placed around incisors engaging labial arch and lingual bars to expand the canine region. Prophylaxis was given. (Five hours.)

November 3 (65 days later). Spur bands for maxillary first premolars were constructed and cemented. The labial arch was readapted to expand all around and adjusted to engage latches on the premolars and lateral bands. A grass line was tied to engage distal end of lingual bar on maxillary left first molar, extending forward to engage the spur on first premolar band to rotate that tooth; on the right side a wire ligature was placed in same manner to rotate the right first premolar. In both instances the ligatures were wrapped around the lingual bars in order to prevent pinching the tongue; at this sitting the mandibular labial arch was readapted more ideally in shape, sprung up to snap into the notches on the first premolar bands to elongate those teeth. Wire ligatures were placed to engage mesial ends of both lingual bars extending forward between canines and lateral incisors to engage the labial arch. The loss of the second deciduous molars and lateral expansion had evidently provided more

space than we desired. It is also obvious that we had cut off the mesial ends of the lingual bars since in the beginning they lapped at the median line. Other teeth were ligated as usual. Continuous use of medium sized intermaxillary elastics was recommended. (Five hours in chair and laboratory. Additional time for conversation.)

Fig. 4.

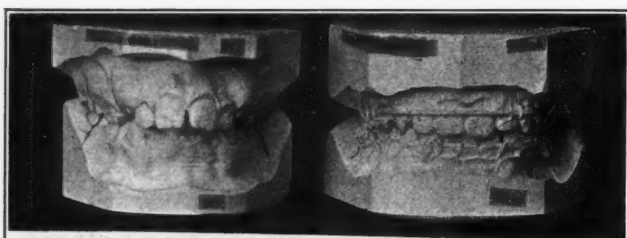


Fig. 5.

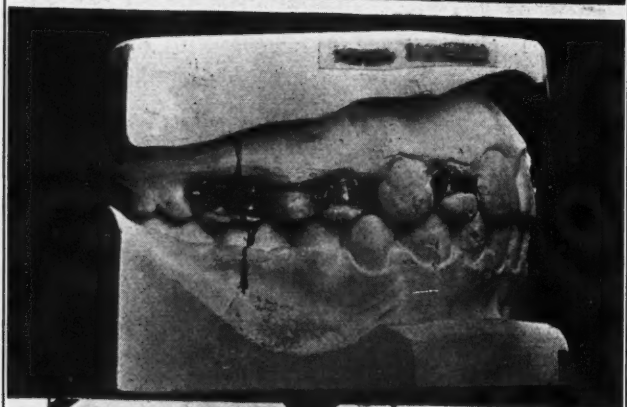


Fig. 6.



Fig. 7.



Fig. 4.—Casts showing condition before treatment and after ten months of treatment.

Fig. 5.—Showing bands used with the appliance.

Fig. 6.—Photographs of patient when treatment appliance was removed for Hawley vulcanite bite plane (two years).

Fig. 7.—After Hawley bite plane had been used seven months.

Nov. 4, impressions for study casts were made (Fig. 4).

Dec. 6 (32 days later). General going over. (Two hours.)

Feb. 14, 1927 (70 days later). General going over. (Three hours.)

April 4 (49 days later). The maxillary arch was readapted to press lingually on central incisors and canines, expansion premolar and molar region. Ligatures were attached to distal extensions on the lingual bars and forward to engage the spurs on first premolar bands for rotation. Mandibular arch, ligatures were placed distal to first premolars engaging labial arch and lingual bars to expand. Ligatures extending forward from mesial ends of lingual bars around the labial arch to engage spurs on lateral bands to rotate lateral incisors and move them labially. The maxillary labial arch was bent mesial to the first premolars to tip down in incisal region and the continued use of elastics was advised (first attempt).

Record notes indicated we hoped to be able to replace the present mandibular treatment appliance with a Hawley removable lingual arch with labial auxiliary spring at the next visit. (One hour.)

July 5 (92 days later). At this time the maxillary right first premolar band was recemented and both labial arches were carefully readapted. Prophylaxis was given. (One and one-half hours.)

August 29 (55 days later). Patient returned with three molar bands loose. They were recemented. Both arches were readjusted more ideally in shape, and stop springs on mandibular arch were tied back to tubes on the molar bands to close spaces. Prophylaxis given. (One hour.)

November 26 (89 days later). Recemented mandibular right molar band, readapted labial arch to expand in molar region. Ligatures were renewed to rotate maxillary premolars. (One hour.)

February 6, 1928 (72 days later). Removed the maxillary treatment appliance. Took impressions for study casts with all bands in position, also one for Hawley vulcanite bite plane. The mandibular arch was readapted and religated. Prophylaxis given. (Fig. 5.) (Three hours, ten minutes.)

February 13 (1 week later). The patient was referred to photographer for picture after which maxillary Hawley appliance was fitted and ligatures on the mandibular arch were tightened. (Fig. 6.)

March 28 (44 days later). At this time the mandibular treatment appliance was removed. Lateral bands with labial and lingual extensions were placed for retaining purposes. (Two hours, thirty minutes.)

July 23 (117 days later). The labial auxiliary to Hawley bite plane was adjusted to press lingually on incisors. Prophylaxis given. (One hour.)

September 10 (49 days later). Mandibular right and left lateral incisor and canine retaining bands removed. Prophylaxis given. Modelling compound impressions. (One hour.) (Fig. 7.)

November 30 (81 days later). Slight readjustment of Hawley auxiliary and touched up vulcanite where causing irritation to soft tissue. (Forty-five minutes.)

June 3, 1929 (185 days later). Modelling compound impressions were taken with Hawley appliance in position, after which a prophylaxis was given. The patient dismissed, and was requested to return at his convenience for observation. (Two hours.) (Fig. 8.)

About one year later he returned with his father. Although we did not secure impressions, a casual examination showed the teeth to be in good occlusion and very nicely aligned.

A letter inclosing photographs from the mother recently states that the teeth are very beautiful and the family is happy over the results. Unless the un-

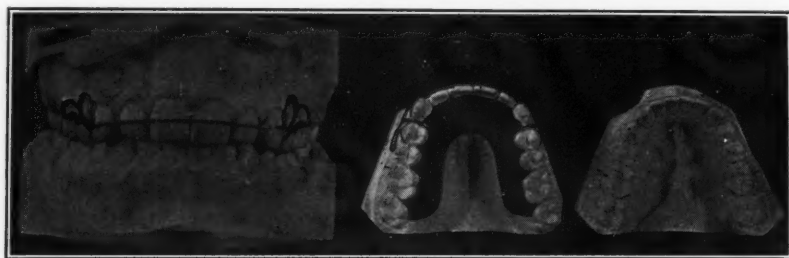


Fig. 8.—After two years' treatment and sixteen months' retention.



Fig. 9.—Photographs of patient four years after use of Hawley retainer had been discontinued.

erupted third molars prove disturbing elements, I see no reason for relapse in this case. (Fig. 9.)

About eight months elapsed between the time we stated we would place Hawley appliance and the actual time the mandibular appliance was removed.

Twenty visits were made, with an average of about two and one-half hours each.

A NOTE ON EXTRACTION IN ORTHODONTIC CASES*

HAROLD CHAPMAN, L.D.S., LONDON, ENGLAND

DURING the past year several people have said to me: "You have become an ardent advocate of extraction as a part of orthodontic treatment." I do not regard that as a correct designation; probably it has arisen from an incomplete study of what I have written: it would be nearly as sensible to describe me as an inlay worker because I have advocated the use of gold inlays for anchorage for bows, in suitable cases, instead of bands; probably I am more in favor of extraction today than I was fifteen years ago, nevertheless, there are many cases that I think are better treated without extraction and many others in which I believe extraction is indicated. However, that is not the main point; extraction must of necessity play a large part in orthodontic treatment at the present time,

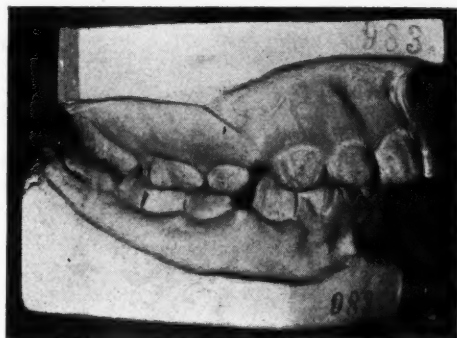


Fig. 1.—Example of removal of $\frac{4}{4} \mid \frac{4}{4}$.

The extraction of $\frac{4}{4} \mid \frac{4}{4}$ is contraindicated in this type of case.

and what I have been particularly concerned about is that when extractions are performed they will really be a benefit to the patient and not a detriment as is frequently the case.

There is considerable misconception in the profession about what and when to extract, and this Society has an opportunity, through its large membership, to do valuable work in elucidating what may be the correct procedure in a particular case; the fact that an individual or this Society is investigating the subject does not make him an "exodontist," but marks him as an orthodontist with a broad outlook, and one who is anxious for the welfare of his patients.

It is not my intention to discuss this question now; I did that at the demonstration meetings of this Society and the British Dental Association, earlier in the year, but I do suggest that this is a subject—what and when to extract—in the investigation of which every member of this Society may take a part. Many of the rules to be found in the literature are inadequately presented or are

*Transactions of British Society for the Study of Orthodontics, 1932.

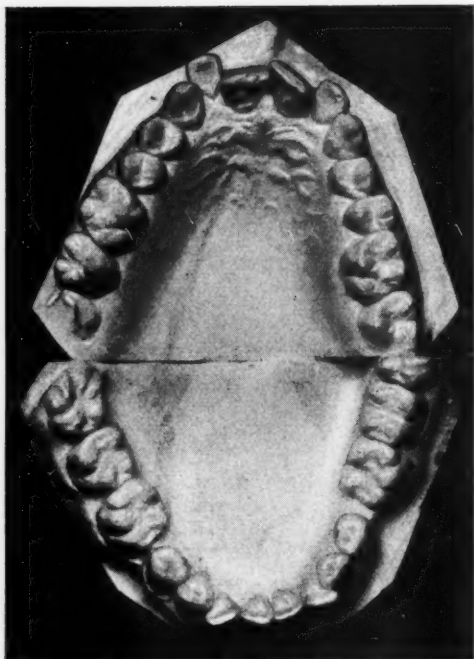


Fig. 2 A.

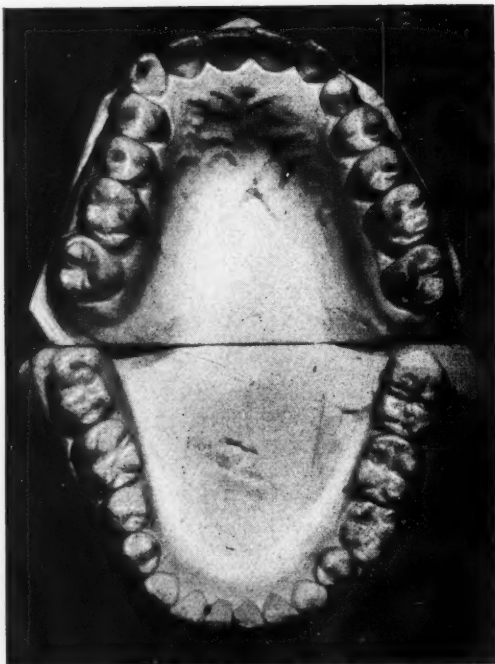


Fig. 2 B.



Fig. 2 A.

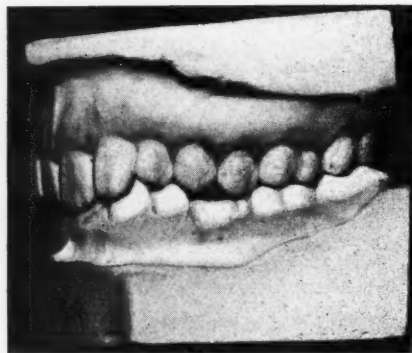


Fig. 2 B.

Fig. 2.—A, Female, aged twenty years and six months, $\overline{e|e}$ extracted at about age of seventeen years; $\overline{5|5}$ have never erupted; loss of $\overline{e|e}$ in all probability has allowed the mandibular arch to become smaller and with it the maxillary arch would become smaller and accentuate the malposition of $\overline{2|2}$; were it possible it would have been better to have left $\overline{e|e}$ *in situ* in order that the size of the maxillary arch be maintained.

B, a similar case, a girl, aged fifteen years and eight months, had $\overline{1|2}$ very slightly prominent; at age of twenty-one years and eleven months; $\overline{1|2}$ was considerably more prominent; its appearance caused advice to be sought; $\overline{1|e}$ had been extracted in the interval (age unknown), which had probably allowed the mandibular arch to collapse and the maxillary one collapsed with it. In the interval $\overline{8|8}$ had erupted. At both periods $\overline{1|c}$ was *in situ* and $\overline{1|3}$ was lingually placed and almost horizontal with its crown close to the lateral root; it is not thought that this condition had any effect on the position of the lateral.

In another case* $\overline{1|1}$ was labial to the other teeth and at age of fourteen years was getting worse: $\overline{6|6}$ had been lost or partially lost.

*"Further cases illustrating the ill-effect on the maxillary arch caused by the loss of the mandibular teeth," Trans. British Society for the Study of Orthodontics, 1933.

incorrectly interpreted if one is to judge by results, for I have seen not a few cases in which the extractions have not given the expected benefits; e.g., four first premolars have been removed when the removal of mandibular premolars is contraindicated (Figs. 1, 2, 3 and 4); in other cases the removal of two first maxillary premolars is advised without further treatment, though this would be necessary to bring about any benefit that the extractions might be able to confer (Fig. 5); the removal of mandibular incisors is an extremely difficult problem.

Treatment by extraction requires individual judgment both as to the tooth to be removed, the time when it shall be done, and the result to be achieved, but when treatment is by nonextraction, "normal occlusion" is the result to be obtained. (Figs. 6, 7, and 8.)

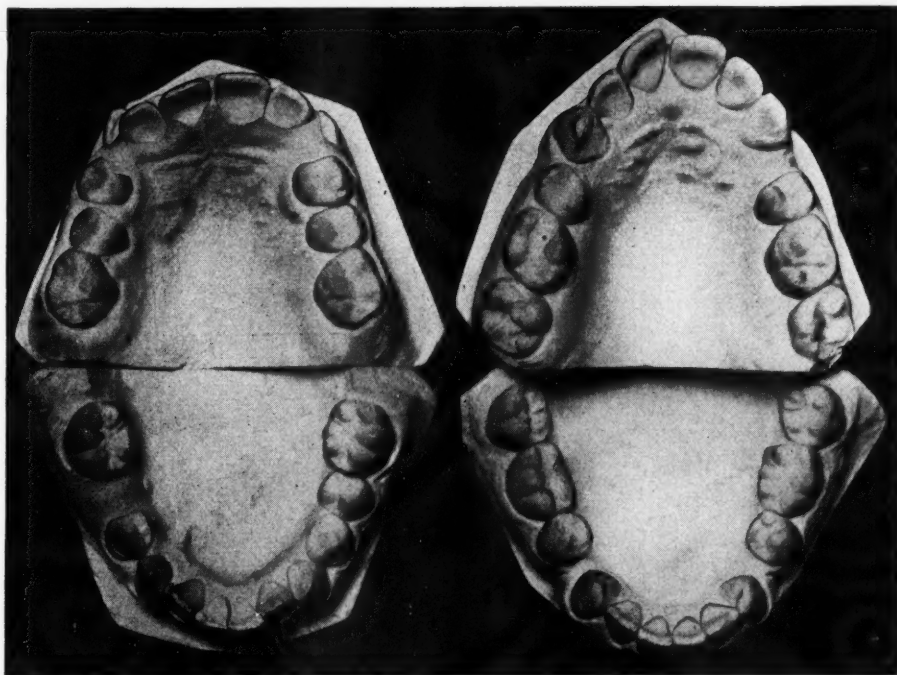


Fig. 3.—Another case in which $\frac{4}{4} \frac{4}{4}$ were removed. The condition five years later, during which time there was more or less continuous treatment, was worse than at the beginning. The removal of $\frac{4}{4} \frac{4}{4}$ and retraction of $\frac{3}{3} \frac{3}{3}$ would have given a good result, as the incisor relations were satisfactory.

Again, the symmetrical extraction of the four first permanent molars is advocated without qualification and at times seems to be acted upon without any discretion (Fig. 9). In cases of postnormal occlusion the removal of any mandibular tooth is, as a general rule, contraindicated (Figs. 1, 2A and 4; exceptions, Figs. 6 and 7). Nor is symmetrical extraction necessary to unlock the bite so that the teeth in one arch may move; the cases in which the posterior teeth do not move medially to close a gap, caused by the loss of a lateral incisor or any tooth behind it, are extremely rare, even if the other arch of teeth is left intact (Fig. 10) and to do this may be and probably is, the better treatment.

All statements as to treatment need so much qualification that it is almost impossible for one to cover all the details that one has in mind: for example, at one of the meetings referred to above, an onlooker remarked that he had had good results from removing mandibular incisors; this at first sight seemed to

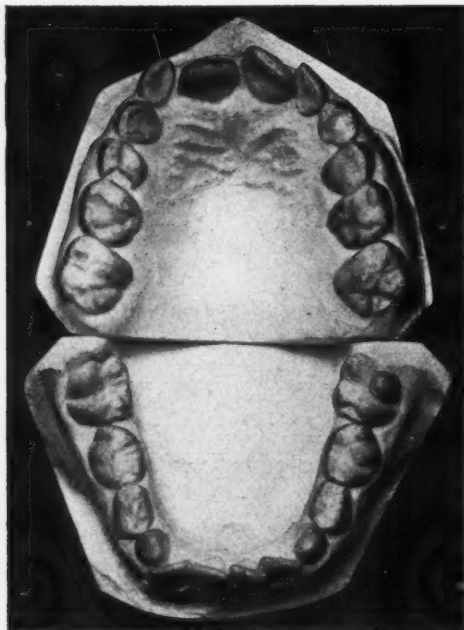


Fig. 4.—A Class II, Div. 2 case to be treated by removal of $\overline{4|4}$; the mandibular arch is fairly good, but in any case a mandibular tooth should not be removed as this could not benefit the alignment of the maxillary teeth. The dentist in charge of the case wrote: "I thought it was quite usual to remove $\overline{4|4}$, as well as $\overline{4|4}$." The right maxillary central incisor is in good relation with the mandibular incisors.

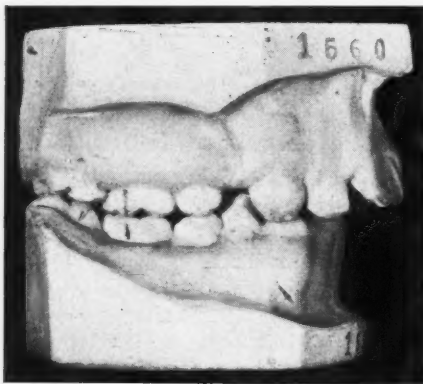


Fig. 5.—The parents of this patient understood that removal of $\overline{4|4}$ would improve the facial appearance by "natural" lingual movement of the six anterior teeth. The position of the lower lip between the maxillary and mandibular incisors effectually prevented this occurring and the closure of the first premolar spaces took place by forward movement of the maxillary cheek teeth, not by backward movement of the front teeth. A mandibular incisor was also removed.

point to a conclusion opposite that which I had formed, but on inquiring, he mentioned that such patients were, what I might term, "old" patients, say sixteen or seventeen years of age, and in certain selected cases I am inclined to

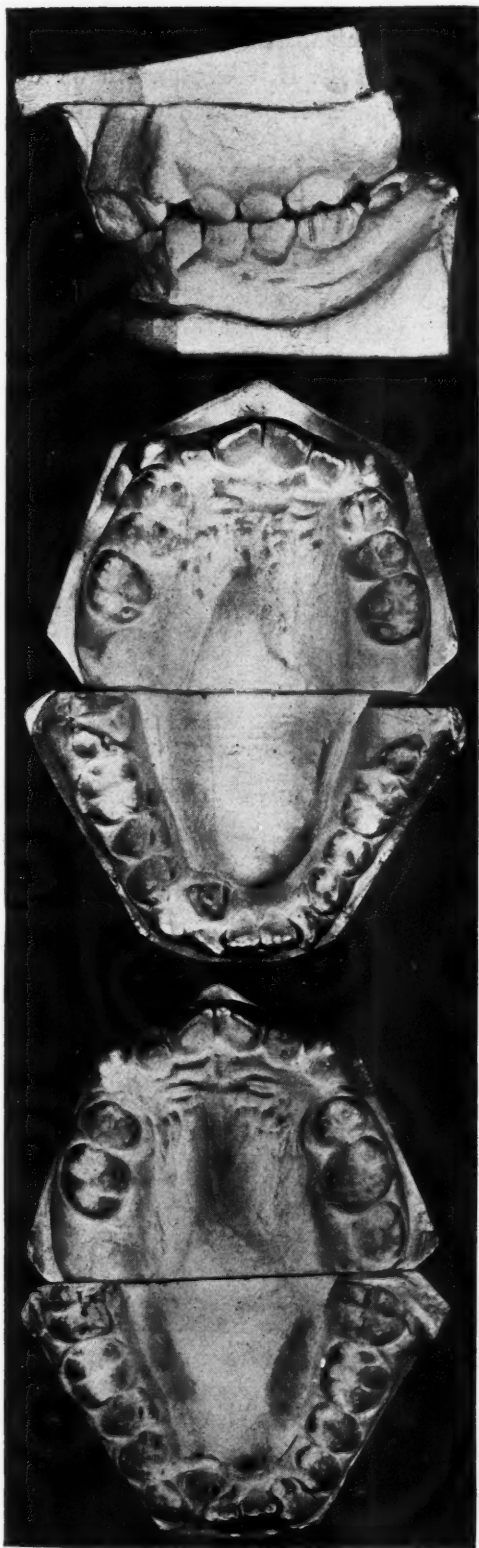


Fig. 6.—Removal of $\overline{11}$ at age ten years and eleven months. Closure of space one year later, so that there was insufficient space for $\overline{21}$.

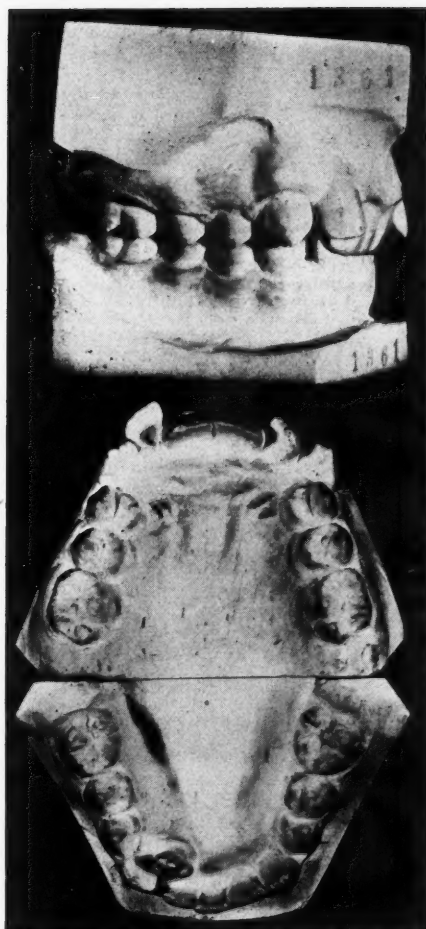


Fig. 7.—Removal of $\overline{21}$ at age thirteen years and three months. In a few months all the incisors and canines were in contact and further collapse of the arch was prevented; probably it would have been better to have deferred the extraction until the patient was seventeen years of age.

think that this is a good time at which to remove a mandibular incisor, so long as the remaining ones need little or no mechanical treatment to align them (Fig. 7); another example is found in a paper by F. H. Gaunson* in which the general principle laid down is to remove the four first permanent molars, but I

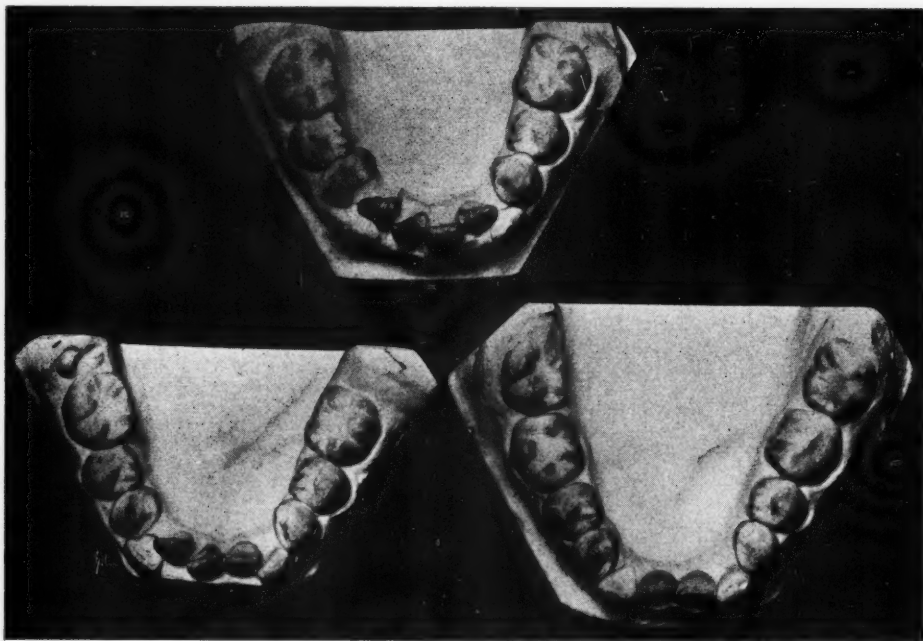


Fig. 8.—Extraction of a mandibular incisor at age thirteen years and one month, extraction of another mandibular incisor five months later. After the latter further collapse of the arch had to be prevented by an appliance.



Fig. 9.

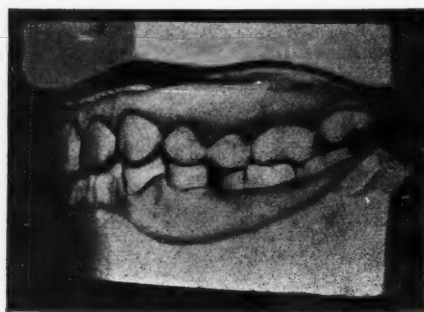


Fig. 10.

Fig. 9. $\frac{6}{6} \frac{6}{6}$ removed at age thirteen years. Spaces remained permanently between some of the cheek teeth, allowing food to wedge between them and cause discomfort. Relations of teeth satisfactory.

Fig. 10.—Closure of $\overline{5}$ space, probably chiefly by medial movement of $\overline{6}$ and some distal movement of $\overline{4}$. The cusps in this case are not well defined, but this does not seem essential for these movements to occur. The distolingual cusp $\underline{6}$ occludes between $\overline{6}$ and $\underline{7}$.

*F. H. Gaunson: The Case for Extracting the First Permanent Molars, Dental Magazine and Oral Topics, 1931.

would regard such treatment as exceptional as regards the cases I see: I have several where this has been done on account of caries and the probability that the teeth could not be kept for many years, but I would prefer removal of the first premolars if the condition of the teeth were similar.

Figs. 1, 5, 6, 7 and 9 are taken from "The Science and Practice of Dental Surgery," edited by Sir Norman Bennett, 2nd edition, by kind permission of the Oxford Medical Publications.

DISCUSSION

Mr. Rix said that in the two cases described by Mr. Harold Chapman, where the maxillary laterals were forced out in patients about the age of twenty, he wished to ask whether Mr. Chapman considered the possibility of forward thrust of the erupting eights in either of those cases. He had seen slight incisor irregularities at about the age of twenty when the third molar had erupted, and he had also seen cases which had been treated collapse at about that age, and he had often put the trouble down to the fault of those erupting teeth.

Mr. Steadman said he had been very glad to hear Mr. Chapman's condemnation of the somewhat common practice of extracting the two mandibular first premolars in addition to the maxillary. He had often extracted the maxillary first premolars, but the occasions when all four could be removed seemed to him rare; so often no good resulted but only harm. He did feel, however, as Mr. Chapman had emphasized, that at the age of fourteen or fifteen, occasionally a mandibular central incisor might be removed in conjunction with the two maxillary first premolars.

Mr. Watkin said he desired to ask Mr. Chapman a question regarding the case where one mandibular second deciduous molar was removed, whether an x-ray picture was taken to decide the presence or otherwise of the unerupted second premolar. It seemed to him that if it was known that the second premolar was absent, the result that occurred might be expected, and it would have been better either to leave the second deciduous molar alone, or to make a compensating extraction in the other dental arch. Another point regarding symmetrical extraction was that in Class I cases where the molars were in normal occlusion and there was considerable crowding in the front, he found it very often useful and safer to take out the maxillary first premolars and the mandibular second premolars. If the four first premolars were extracted, there was a risk of the remaining maxillary second premolars coming in front of the mandibular second premolars.

Mr. King said he had brought with him to the meeting some models which he thought would illustrate those points which Mr. Chapman had been speaking about, and with the President's permission he would pass them round.

Mr. Samuel Downing said he always felt that practitioners were inclined to be rather phrase-mongers, and that certain phrases had rather misled them—phrases like "judicious extraction" and "judging each case on its own merits." Some members had been inclined to rely on these phrases as the sum total of their practice. The question of the extraction of premolars in postnormal occlusion cases was one that was always being brought up in hospital practice. One constantly saw premolars removed in the expectation that the incisor teeth would travel back, which, of course, they very seldom did, though they did sometimes. The rule that had always guided him in extracting teeth was "Would extraction alone give a good result?" If an appliance was likely to have to be used subsequently to the extraction, then he had tried to do without the extraction.

A member said he thought the pitfall that Mr. Downing had mentioned might very well be turned to good account if everybody observed that excellent rule of having radiographs made of every patient presenting for orthodontic treatment. That should be part of the routine in these days. If a parent was prepared to spend any fee at all on the regulation of his children's mouths, it seemed to him that the taking of radiographs should become part of that fee in the course of treatment. It was not a question of considering the extra expense

involved, and in hospital practice it most certainly should be done as a matter of routine, for the simple reason that hospitals were there to teach students how to do their work—at least, incidentally.

Mrs. Michaelis said that as regarded the question of x-ray pictures it did not appear to her that there could be any question, because quite apart from the point of finding or not finding premolars it was an impossibility to commence treatment in orthodontic cases without finding out whether there would be a supernumerary tooth.

Mr. Visick said that in listening to Mr. Chapman's talk it had struck him how extraordinarily the maxilla was influenced by the mandible. In so many of Mr. Chapman's cases teeth were extracted from the mandible, and the result in the maxilla was very marked. The longer he practiced orthodontics the more he realized the sort of fluidity or plasticity of the jaws—that if one removed a brick in the mandibular arch the maxillary arch was going to fall out. It was good to be reminded that extractions had to be very carefully thought about before they were undertaken.

The President pointed out that Mr. Chapman, in his last case but one, had not said whether the teeth were removed for caries or not. He wondered whether, before criticizing the extraction, he had ascertained whether those first permanent molars were saveable or not, because if not, the criticism seemed rather hard on the man who had taken them out.

Mr. Chapman, in reply, said the President had reminded him of an error to which he for one must plead guilty of falling into very often, and that was for appearing to criticize the man who removed the four permanent molars without knowing what the original condition of the case was. He must confess that he did not know, and perhaps he would have done the same thing as the other man if he had been in his shoes, but nevertheless the fact remained, that the removal of the four permanent molars was not entirely satisfactory. As a matter of fact, the patient had a considerable amount of caries, and he doubted whether she would have been very much worse off if she had had the first premolars removed rather than the first permanent molars. He thought the question about x-ray pictures had been fully answered for him, but he could say definitely that there was a necessity to emphasize that point at all meetings. It was absolutely essential to x-ray all the teeth, whatever was going to be done. One did not know what one was going to find, and it was much better to know beforehand than to discover afterward when it was too late to take the necessary compensating measures for any abnormality that might be found. Mr. Rix had given the criticism which he had expected in regard to the lateral incisors becoming more prominent after a few years. Such a case was illustrated in Bennett's second edition, where there was some additional crowding when the third molars erupted but not to the marked extent shown in the case he had illustrated on the screen. He felt that he was very much to blame for not having a model of the case that had the two out, when he could have had the impressions. He could not help thinking that the arch must have collapsed for those spaces to become so small in about four or five years, the teeth being taken out at about sixteen or seventeen. In regard to Mr. Watkin's question, that was the case in which there was one mandibular deciduous molar left. That was x-rayed. He knew there was no tooth underneath. Of course, it was five or six years ago, and whether he impressed on the patient at that time that she must on no account have that tooth out he did not recall. He could quite see now that he ought to have emphasized that point to the patient herself. Mr. King's cases showed very well two of the points that he had raised.

PHOTOGRAPHY WITH PROCESS FILMS AS POSITIVE PRINTS*

GEORGE L. TURNER, D.D.S., LOS ANGELES, CALIF.

PHOTOGRAPHIC record of progress and results obtained by means of orthodontic treatment is of inestimable value not only from the standpoint of clinical information but also on account of the interest and appreciation manifested by the patient and the parents during the period of treatment and when the case is completed. It is so rarely possible to secure the services of a competent commercial photographer who fully comprehends the requirements of the orthodontist that I am of the opinion all photographs should be made in the orthodontist's office. The technic shown here is now so standardized that any one capable of using a kodak and of finishing x-ray films, can do his own photographic work satisfactorily, as well as inexpensively.

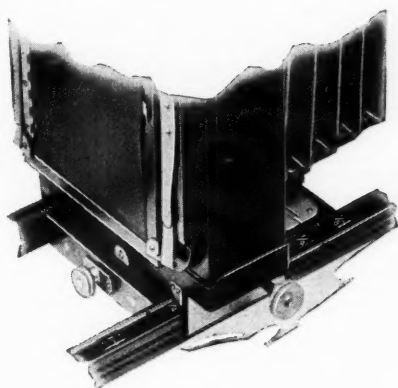


Fig. 1.

The application of the Mazda photoflash lamp in clinical photography eliminates all possibility of movement of subject and incorrect timing of exposure. This use of the Mazda photoflash lamp should be accredited to Mr. Don Pounds, in the office of Drs. Ward and Betts of Spokane. The small expense of these lamps is forgotten when you are able to obtain such splendid results in every instance where standardized technic is carefully followed.

Clinical photographs should have microscopic detail. Also it is advisable that they be made to a definite scale so a designated size of the subject will be identical in all succeeding photographs. This is absolutely necessary in photostatic photographs to be used in conjunction with gnathostatic casts. By means of a focusing scale on the track of the clinical camera, as illustrated in Fig. 1, this is easy to accomplish by setting the film-holder compartment at the desired scale indication and so placing the camera in relation to the object that the image will be in sharp focus on the ground glass. In other words, for a

*Clinic presented at the Thirty-Second Annual Meeting of the American Society of Orthodontists, Oklahoma City, November, 1933.

full-scale photograph, set the scale marker at "1" on the camera bed and have the camera lens 16 inches from the object. For a half-scale photograph, set the scale marker at " $\frac{1}{2}$ " and with a distance of two feet between the camera lens and the object. Such standard arrangement of camera, lights, and object is illustrated in Fig. 2. The 5 × 7 in. Eastman super speed safety portrait film has been found most suitable for our photography since the bulk of the work is essentially close up, requiring the greatest amount of detail in the area of interest.

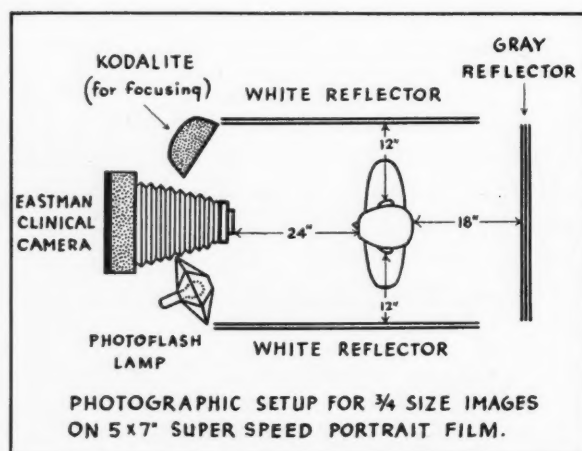


Fig. 2.

The equipment and materials necessary for successful clinical photography with the Mazda photoflash lamp do not require a large investment. The following essential articles may be secured from your regular photographic dealer:

- Eastman clinical camera outfit.
- Folmer compact stand or tripod.
- Kodalite for illuminating object during focusing.
- Gray or black background, preferably gray.
- Photoflash lamp reflector with batteries.
- Mazda photoflash lamps.
- Eastman super speed safety portrait films 5 × 7 in.
- Eastman process films 5 × 7 in. (for positives).
- Chair, preferably with an adjustable headrest.
- Large size processing tank, such as is used in x-ray technic.

When focusing has been completed, the kodalite may be switched off as it is not needed in making the exposure, the photoflash lamp alone being used for that purpose. The diaphragm is closed to f.32; the shutter is closed; the film-holder containing super speed safety portrait film is placed in the film-holder compartment, and the slide removed. Now the shutter is opened and the photoflash lamp pointed at the object so that an angle of 45 degrees is formed; it is held slightly above and behind the camera lens. (The light from the lamp should never be directed into the lens.) When the battery switch

or button is pressed, the exposure is made. To complete the procedure, it is necessary only to close the shutter and replace the slide in the holder.

It is not safe to handle photographic films in the processing room light ordinarily considered safe for x-ray films, so before loading or unloading film-holders, Series 2 (red) or 3 (green) safelights should be substituted in the safelight lamps for the Series 6-A (yellow green) safelights which are used when handling x-ray film. For convenience in developing, 5 × 7 in. film developing hanger No. 4 should be used, as it holds the film flat and eliminates buckling or curling and corner holes. The film should be developed for eight minutes in regular x-ray developer solution at 65° F. Thorough rinsing, fixation for fifteen minutes (regular x-ray fixing solution), washing for thirty



Fig. 3.

minutes in circulating water, and proper drying complete the processing procedure. Fresh developing and fixing solutions, proper temperature and timing, and thorough washing will afford satisfactory results. *Do not* expect results if any one of these factors is neglected.

Regular paper prints may be made with either Azo or Velox glossy paper, providing highest quality prints containing all the detail recorded in the negative. For average negatives, Azo No. 2 Grade F is recommended.

When photographs are to be prepared for exhibition, it is best to show them as transparent positive prints mounted in convenient cardboard mounts. When suitably mounted and placed before a good illuminator, the demonstration is exceptionally effective because all the recorded detail will show with

great brilliance. These transparent or process positive prints are printed from the negative on Eastman process films, and will give much greater detail than any paper print from same negative. Place the process film with the emulsion side on the dull side of the negative in the regular printing frame. A very short exposure, depending on the density of the negative and source of light, is all that is required. Now develop this film in exactly the same manner as described for the negative, namely—develop eight minutes at 65° F., rinse, fix for fifteen minutes, wash for thirty minutes and dry. Development and fixation of both negative film and positive transparent process film is accomplished with regular x-ray solutions.

With the certainty of high quality results brought to clinical recording by employing the Mazda photoflash lamp method, there should be no question as to the advisability of making clinical photographs as a routine measure. The amateur as well as the experienced photographer can produce satisfactory results with the paper prints as well as the transparent positive prints. The photographic quality that will be obtained is something that has heretofore been considered impossible even when using expensive lighting equipment. Such process photographs furnish invaluable records, so obviously required in the history of orthodontic cases.

A MANDIBULAR BITE PLATE WITH CHIN-OCCIPITAL TRACTION AND CHIN ANCHORAGE*

RALPH W. EATON, D.D.S., ROCHESTER, N. Y.

THE mandibular bite plate is an appliance used in the treatment of open-bite cases to depress the molars when the deformity is the result of a supra-clusion of these teeth. It is a simple vulcanite bar plate covering the occlusal surfaces of the molars and premolars and is held in position by a labial wire or buccal clasps.

In adult cases and with older children it is used with chin-occipital trac-

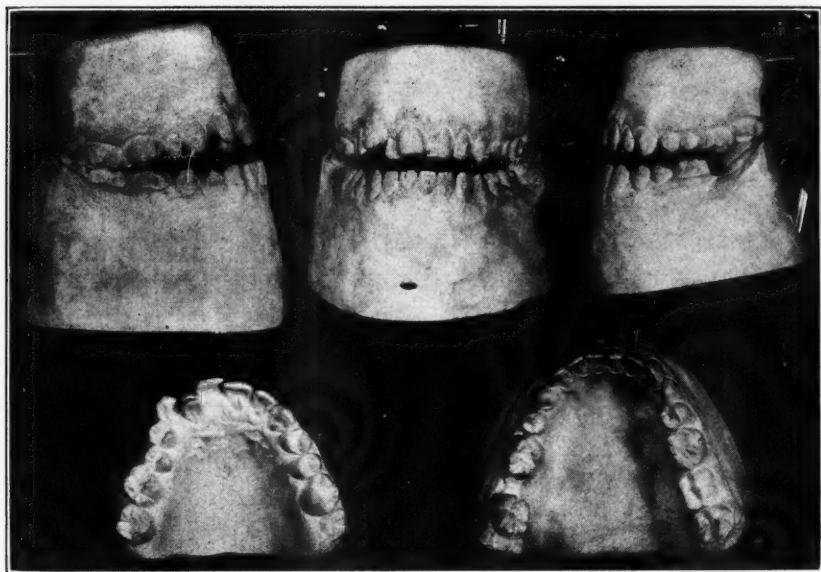


Fig. 1.—Casts before treatment.

tion at night, rather than depending entirely on muscle pull, since the treatment will be greatly shortened.

Chin anchorage is used to move teeth anteriorly in the dental arches. The teeth to be moved are attached to a chin cap by elastics, while the chin cap is held in position by other elastics to a head gear. It is a most useful anchorage where teeth in both the maxillary and the mandibular arches are distal to normal.

Chin anchorage offers an immovable base and permits the movement of several teeth at the same time. Because of its appearance, it is used only at night. Intermaxillary anchorage with light elastics may be used during the day to hold a part of the gain made during the night. It may be used to ad-

*Clinic presented at the Thirty-Second Annual Meeting of the American Society of Orthodontists, Oklahoma City, November, 1933.

vantage in the treatment of some types of micromaxillary development, especially those with retarded or collapsed anteroposterior growth, often erroneously diagnosed as mandibular prognathism.

The following case report will show the application of the mandibular bite plate with chin-occipital traction and the use of chin anchorage.

The patient was twenty years old. In the whole mouth only two maxillary

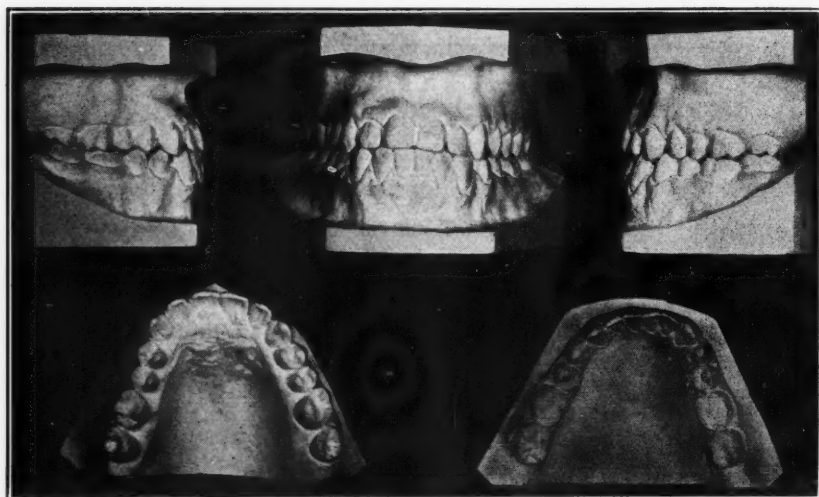


Fig. 2.—Casts after treatment.



Fig. 3.

Fig. 4.

Fig. 5.

Fig. 3.—Position of chin and head cap while using chin anchorage to move teeth anteriorly.

Fig. 4.—Position of chin and head cap while using chin-occipital traction with mandibular bite plate in position.

Fig. 5.—Chin anchorage with elastic from chin cap to buccal tube on maxillary molar. This view also shows occlusion of the teeth after molars were depressed.

teeth were in contact with three mandibular teeth. Both the speech and the masticatory functions were greatly affected.

The maxillary left first molar was extracted at the age of thirteen years, the mandibular left second molar at the age of seventeen, and the maxillary right

third molar at the age of twenty. The maxillary left lateral incisor, canine and premolars drifted distally, while the maxillary left second and third molars drifted mesially to close the space entirely. There was also some drifting dis-

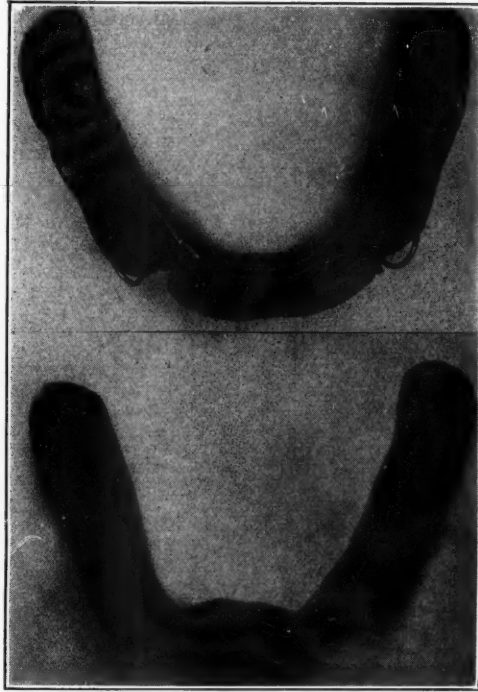


Fig. 6.—Views of mandibular bite plate.



Fig. 7.—Profile of patient before and after treatment.

tally of the mandibular left canine, premolars, and first molar. The mandibular left third molar was tipping badly and drifting mesially. The case was treated as follows:

The mandibular right third molar was first extracted. Correction of the open-bite deformity was effected by using the mandibular bite plate with chin-occipital traction at night to depress the molars in supraclulsion.

The maxillary left molars, premolars, canine, and lateral incisor were then moved anteriorly with the chin anchorage at night, and light intermaxillary anchorage during the day.

The mandibular left third molar was next moved mesially with the chin anchorage and tipped into position. To avoid crowding, the mandibular right first premolar was not rotated.

No attempt was made at any time to move the maxillary anterior teeth down or the mandibular anterior teeth up, since the bite was closed by depressing the molars. The total time spent in active treatment was one and one-half years. The only retention used was a vulcanite retainer on the maxillary arch.

These cases of supraclulsion of the molars treated with the mandibular bite plate show no tendency to relapse, because of the natural contracting habits of the muscles.

COIL SPRINGS AS APPLICATION OF FORCE*

EDMOND B. ARNOLD AND J. S. CUNNINGHAM, HOUSTON, TEXAS

CASES 1 through 4 have been selected from many cases of neutroclusion that we have treated with the coil spring, and we want particularly to stress how well lateral development was obtained without any tipping whatsoever, as can be easily seen by studying the occlusal and occluded views of these cases after treatment. Of course, like any other appliance, if too much pressure is applied, the teeth will tip; therefore care must be exercised not to apply too much pressure when the adjustments are made. The amount of the adjustment that we put in the coil spring is from 2 to 3 mm., and in no event do we use more than 3 mm. Adjustments should not be made oftener than once every six weeks; and if there is still pressure in the coil spring, no more pressure should be applied.

CASE 1.—Fig. 1 *A* shows model of a girl aged seven years. Fig. 1 *B* shows an occlusal view ten months after treatment was begun, at which time the case was put on a rest period. Fig. 1 *C* shows occluded view of the case before and after treatment. The appliance used in this case was a lingual coil spring expander as shown in Fig. 6. After a little expansion was obtained, simple finger springs were added to the mandibular appliance as shown in Fig. 7, and an 0.032 labial arch was placed on the maxillary appliance for intermaxillary ligatures. Amount of expansion gained was 7 mm.

CASE 2.—Fig. 2 shows the case of a boy aged six years. This case was treated like Case 1. Time of treatment was twelve months. Amount of expansion gained was 6 mm.

CASE 3.—Fig. 3 shows the case of a boy aged seven and one-half years. Nothing was used but expanders as shown in Fig. 6. Fig. 3 *B* shows simple anterior finger springs in position. Coil spring had been removed, and stop was adjusted against round tube as expansion was gained. Time of treatment was ten months. Amount of expansion gained was 7 mm.

CASE 4.—Fig. 4 shows the case of a boy aged six years, treated fourteen months. The only appliances used in this case were a coil spring expander, shown in Fig. 7, and central anterior finger springs on the mandibular appliance. No labial arch was used. Amount of expansion gained was 9 mm.

CASE 5.—Fig. 5 shows the case of a boy aged ten years. Case was treated twenty-three months. Both arches were very much constricted, and there was decided protrusion of the maxillary anterior teeth (Fig. 5 *A* and *C*). Because of the premature loss of the mandibular second deciduous molars the first per-

*Clinic given at the Thirty-Second Annual Meeting of the American Society of Orthodontists, Oklahoma City, November, 1933.

manent molars drifted mesially, and the anterior teeth and first premolars drifted distally. The case was treated with appliances as shown in Fig. 5 A and C. Coil springs as shown on the mandibular labial appliances not only moved the molars distally, but also moved the first premolars mesially. The first

Fig. 1.

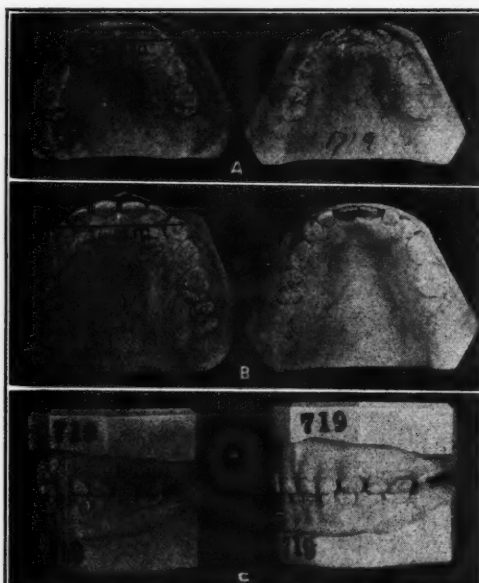


Fig. 2.



Fig. 3.



Fig. 4.

premolars were moved mesially with a spur soldered to a round tube that slides freely on the labial arch. Both maxillary and mandibular labial arches were adjusted with expansion so as not to work against the lingual expanders. In the maxillary labial appliances the stops were against the tubes. However, during the treatment the stops were moved away from the tubes in order to allow the anterior teeth to be moved lingually by the use of intermaxillary

ligatures. The intermaxillary ligatures were not applied until the mandibular first molars had been moved distally to their normal position.

Fig. 6 shows expander with coil springs in position. A stop is soldered on the maxillary appliance, and in the mandibular appliance the coil is directly against the round tube. The springs are not soldered in any way but simply fit over the 0.040 wire.

Fig. 5.

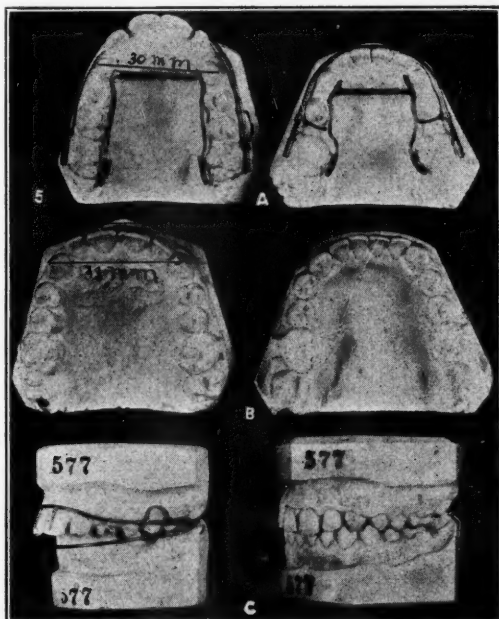


Fig. 6.

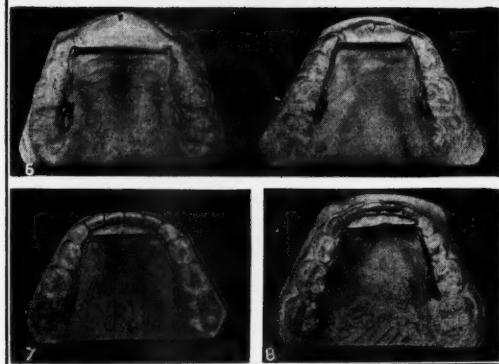


Fig. 7.

Fig. 8.

Fig. 7 shows an appliance with coil spring removed after expansion has been gained and the attachment of simple anterior finger springs for the purpose of moving the mandibular anterior teeth labially.

Fig. 8 is the same as Fig. 7 except that it shows a recurved anterior finger spring instead of a simple finger spring.

The material used in the coil springs is S.S. White's wire 0.010 coiled to fit 0.040 wire. Stainless steel may be used, but it should be of smaller wire, such as 0.007 and 0.008.

FOUR CASES OF IRREGULARITY IN THE MAXILLARY INCISOR REGION*

F. BOCQUET BULL, M.R.C.S., L.R.C.P., L.D.S., LONDON, ENGLAND

ONE SUPERNUMERARY TOOTH

M W., a girl aged eight years six months. The original condition is shown in Fig. 1 before the loss of the deciduous incisor teeth. This is of interest as it shows the maxillary left deciduous central incisor rotated in the same direction as the permanent successor seen in Fig. 2. The irregularity was due



Fig. 1.



Fig. 2.



Fig. 3.



Fig. 4.

to the presence of an unerupted supernumerary tooth, which was removed in June, 1930. I regret that the x-ray film of this case has been mislaid. The permanent central incisor was rotated later by means of fixed apparatus.

This apparatus consisted of a labial bow combined with grass-line ligatures. It was fitted on September 30, 1931, and a retention plate was fitted on January 22, 1932. The ligature ran from the palatodistal part of the incisor to a notch in the bow (Figs. 3 and 4).

*Transactions of British Society for the Study of Orthodontics, 1932.

TWO SUPERNUMERARY TEETH

L. B., a boy aged seven years. The condition is seen very well in Figs. 5 and 6, and is notable for the presence of two supernumerary teeth in the incisor region of the maxilla, causing a complete displacement of the 1 | to the right, together with a rotation through a complete right angle, the mesial border facing anteriorly. The mandibular incisor teeth have been naturally somewhat affected.



Fig. 5.



Fig. 6.



Fig. 7.

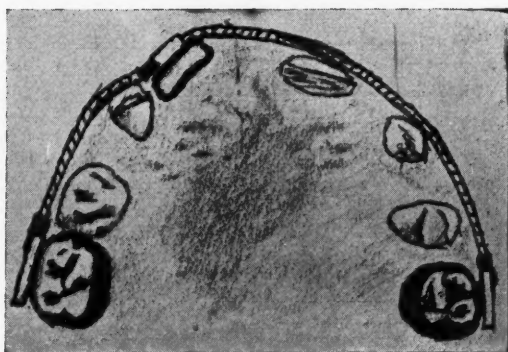


Fig. 8.



Fig. 9.

The treatment of the case consisted of the removal of the supernumerary teeth and the rotation of, and movement toward midline of 1 |. The supernumerary teeth were extracted some time previously to the commencement of the treatment by appliance (Fig. 7).

The first appliance was a simple palatal plate with a labial wire, and a small finger spring pressing on the distal border of 1 | fitted on November 24, 1930. Owing to the poor eruption of the molars the plate was not too stable

in the mouth, and although some improvement was made, an all-screw upper bow was fitted in February, 1931. A rough diagram of this apparatus is seen in Fig. 8. On September 14, 1931, a maxillary retention plate was fitted. Fig. 9 shows the condition when the retention plate was fitted.

THREE SUPERNUMERARY TEETH

V. M., a girl aged eleven years six months. The condition shows irregularity in the maxillary incisor region (Fig. 10) as follows: 1| unerupted; |1 outstanding and higher than the level of the rest of the arch. Two super-

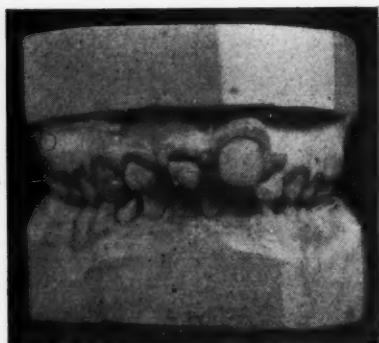


Fig. 10.

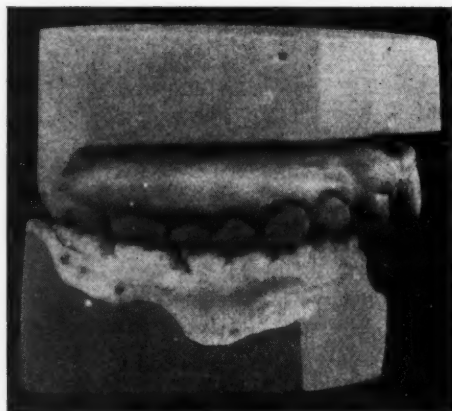


Fig. 11.



Fig. 12.



Fig. 13.

numerary teeth are seen, one in the situation that should be occupied by 1|, and the other just distal to the situation that should be occupied by |1.

Apart from this irregularity, the arrangement of the other teeth (apart from a very slight overcrowding in the mandibular incisor region), and the relationship of the teeth of the maxilla and mandible, is much above the average (Figs. 11 and 12). I point this out, as had the patient not been troubled with these supernumerary teeth, she would have been blessed with a rare condition—a practically perfect denture. When the maxillary incisor region was x-rayed, a third supernumerary tooth was seen, distal and to the right of the

supernumerary tooth on the right side (Fig. 13). The three supernumeraries were removed under a general anesthetic December 1, 1931. No other treatment was undertaken, and on March 3, 1932, 1 was at a slightly lower level and had moved palatally to an appreciable extent (Figs. 14 and 15).

Repeated applications to the patient to present herself again have been futile, and I can only show you this case as being one of a rather rare condition, instead of, as I had originally hoped, a corrected case either with or without treatment—apart, of course, from the extraction of the supernumerary teeth.

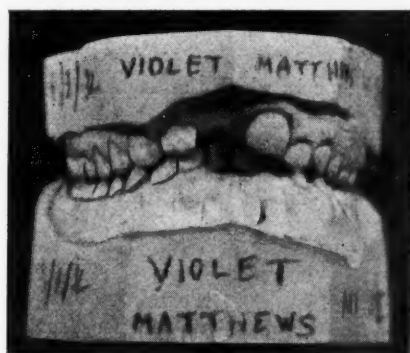


Fig. 14.



Fig. 15.

TRAUMATIC LOSS OF THE MAXILLARY CENTRAL INCISOR TEETH

(Report as given to me by my assistant house surgeon. It has not been altered to the hard materialistic version of most reports, as I consider it gives, like the resultant maxillary arch, "a very pleasing" account of the case.)



Fig. 16.

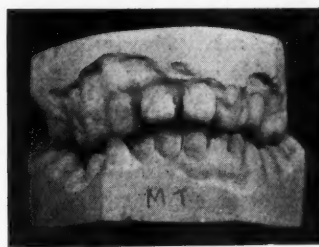


Fig. 17.

G. T., aged twelve years four months. Between the age of six and seven, Gwendoline—while riding her fairy cycle—crashed into a full-sized bicycle coming in the opposite direction. Her partially erupted maxillary central incisors struck the bicycle's handlebars and were knocked straight out into the road, the roots and apices intact.

As soon as the maxillary laterals commenced to erupt, on advice of her mother, Gwendoline learned the habit of pressing the two lateral teeth together

with her finger and thumb, whenever her hands were not otherwise occupied. As a result she—at the age of twelve years—has a very pleasing maxillary arch with the lateral incisors slightly spaced, and good contact elsewhere, the whole result being quite natural (Figs. 16 and 17).

This case is of interest for the following reasons:

1. It is a case which goes to prove that the patient being of a suitable age when a tooth is lost by trauma or extraction in the incisor region, it is advisable to allow the space to close up rather than to condemn the patient to the use of a denture by retaining the space.
2. The distance which teeth will move to close up a space.
3. The cleverness of maternal instinct.

DISCUSSION

Mr. Chapman said that one of Mr. Bull's cases, the one in which the deciduous maxillary central incisor was rotated, reminded him of one he had seen about a week previously. He had seen a similar case (a boy six years of age) in which there was a supernumerary tooth between the deciduous central incisors. These, however, were quite straight, but one of the permanent central incisors beneath was rotated through 90 degrees, the same as in Mr. Bull's case.

Mr. Steadman said the first thing he had noticed about Mr. Bull's last case was that in spite of the enormous room that was gained by the loss of two central incisors, yet the second premolar on the left side was crowded out of the arch. That was very curious, he thought, in view of the enormous space left due to the loss of the two central incisors.

Mr. Broderick said he desired to ask a question as the junior member of the Society. When the two central incisors were knocked out, and the two lateral incisors came together, it made a nice job, but if only one central were knocked out it would not look so nice. In those circumstances, would it be legitimate to take out the other central?

Mr. Steadman said that he could not agree with Mr. Broderick's remarks, and it was often not unsightly when a single central incisor remained in the midline. The loss of only one central incisor was always preferable to two.

Mr. Bull said he thought that question depended a good deal on the age of the patient. He did not think one would expect it to happen in the case of an "elderly child," if he might use that expression, as one would in the case of a younger child. He thought that each case had to be considered by itself.

Mr. King asked Mr. Bull what was the condition of the mandible. It seemed to him that the mandible would be very much too big, so much having been lost in the maxilla.

Mr. Bull said he presumed that the teeth drifted in a forward direction, and, as Mr. Steadman had mentioned in referring to the "crowding-out" of the maxillary right second premolar in a palatal direction, the teeth had come forward tremendously. He thought that the relationship of the maxillary and mandibular arches provided a thoroughly good denture.

Another member asked whether Mr. Bull would say if the mandibular incisor was in such a position in relation to the maxillary that the maxillary tooth could fall back so as to come into line. It seemed to him that if the denture was a normal one it would not be possible to pull the teeth sideways. He could give a case in point from his own practice, where a lad of six or seven years of age had lost both central incisors in exactly the same way as in the case described by Mr. Bull, and now at the age of twenty he had a very unsightly gap about the width of one central.

Mr. Bull said that perhaps the mother of the last mentioned patient was not quite so sensible as the mother of his own patient, because the treatment adopted by his patient's mother had greatly aided the movement of the lateral incisors. He had never seen the patient until the treatment was completed.

DEPARTMENT OF DENTISTRY FOR CHILDREN

OPERATIVE PROCEDURES IN THE MANAGEMENT OF DECIDUOUS MOLARS*

KENNETH A. EASLICK, A.B., D.D.S., ANN ARBOR, MICH.

AT THE present time as much and probably more space in current dental literature is being devoted to articles pertinent to the practice of children's dentistry than to any other of our specialties. More and more is being written about preventive dentistry and preventive medicine. More and more it is being recognized that preventive practice for the dentist must begin with the very small child. I think, therefore, that the organization of this society was a timely and progressive step by the men interested and that such an organization marks these men as leaders in the movement for prevention.

In operative procedures for deciduous molars, one should not be unmindful that *diagnosis*, related as it is to *radiography*, to pediatrics, and to obstetrics, is an important part of children's dentistry and one which is going to increase in importance. The fundamentals, too, of diet and nutrition must be acquired by every children's dentist. Both child management and good office economics must be incorporated in a juvenile practice to make that practice successful. Much that is interesting and instructive can be said about the anatomy and physiology of the deciduous and mixed dentitions, about the influence of the endocrines (vaguely as this influence is now known) on dental caries and growth, about extractions and minor surgery for children with both local and general anesthesia, about oral hygiene and about preventive orthodontia. There are other teeth in a child's mouth besides his deciduous molars: the deciduous anterior teeth often need care and the first permanent molar is a special subject in itself. To me, however, and, I think, to most of the men who are doing children's work, the proper management of a proximal cavity in the deciduous molar of a young child presents the hardest problem in children's operative dentistry. Without this drawback, children's dentistry would be fun.

Any operative procedures for children's teeth must pass four tests: Are they simple? Are they practical? Are they rational and, above all, are they adequate? Complex procedures will be discarded by the operator and will not be tolerated by the child patient. Procedures, theoretically correct, may not yield a profit to the operator after he pays his office overhead. Empirical

*Read before Michigan Society for the Promotion of Dentistry for Children, Detroit, January 21, 1933.

procedures are out of tune with the new spirit of research and investigation. A highly adequate filling is required to replace the proximal of a deciduous molar from three or four years of age to ten or eleven years of age, when this molar is normally exfoliated. Children's operative procedures which do not survive these four tests are valueless, and they richly deserve criticism.

PIT AND FISSURE CAVITIES

When the work of the obstetrician and the pediatrician and our prescribed dental diet and oral prophylaxis fall down, and the small child develops incipient pit and fissure cavities, the best preventive dentistry becomes good operative dentistry. Fill these tiny fissure cavities as soon as a fine explorer catches in them, with small but carefully placed silver amalgam fillings. If we are going to practice "prophylactic odontotomy," let us practice permanent "prophylactic odontotomy." I can see no reason for using black copper cement or a germicidal silicate in these fissures. We no longer think of using temporary filling materials for an adult, why should we for a child? For a permanent filling these fissures will not need carrying out beyond the extension secured by a No. 34 inverted cone or 557 cross-cut fissure bur. They can be packed with a root canal plugger.

PROXIMAL CAVITIES

When our dietary and prophylactic measures fall down still farther and the small child develops interproximal caries in these molars, the best preventive dentistry again is operative dentistry. Good operative dentistry should detect these incipient decalcifications at the contact points and fill them immediately before there is any chance of pulp involvement. How are we going to catch these cavities in their incipency, and how are we going to fill them adequately?

(1) DIAGNOSIS

The only way to find these incipient interproximal cavities is by means of the interdental x-ray film and full head plate. The crowns of the deciduous molars are short and squat, and their marginal ridge contact is broad, which makes it frequently impossible to locate an interproximal cavity with a mirror and explorer until that cavity is getting close to the pulp. A routine check-up periodically by a child's bite-wing film should be instituted in every suspicious mouth. Promiscuous full mouth radiograms, no matter how much information they occasionally yield regarding resorption, congenital absence, supernumerary teeth, and so forth, are not being recommended. These complete radiograms are indicated frequently in a children's practice, but one can obtain a large amount of useful information from two posterior bite-wing films, as a periodic check-up, at a much lower expense to the patient's parents.

(2) FILLING MATERIALS

Considering that the incipient interproximal cavity is located, how are we going to take care of it? The ideal way, where the patient's parents are adequately educated dentally and are adequately able financially, is by use

of the cast gold inlay. Dr. Willett's¹ type of restoration—a T-shaped casting with a full slice on the proximal and a long buccal and lingual groove for retention has been tried. Instead of using his tray-and-compound impression and direct-indirect technic, a copper-band-compound impression is taken and the indirect technic employed. This gives greater accuracy plus a die upon which to finish and polish the casting. Any of you who have tried to grind the sprue from one of these spiderlike castings without a die will appreciate the convenience of the indirect technic.

Our success with Dr. Willett's inlays has convinced us that they have distinct merit as deciduous tooth restorations, especially in the very young patient. They restore anatomy and contact point ideally, with little chance of the restoration impinging upon gingival tissue. Cavities for them can be cut painlessly, if noisily, with stones. Cavity preparation, so far as chair time is concerned, is economical (cavities can be cut in fifteen minutes and the inlays set in the same length of time, if one's guess as to contact and occlusion is approximately correct and if the inlay has been previously polished on the die). Such fillings are inserted with a thin layer of cement for insulation, and their final insertion is simple and painless, since no matrix is required.

On the other hand, cost to the patient is going to be their chief disadvantage. Dr. Finn Bronner² of New York University, in discussing different systems of inlay preparation, criticized the Willett preparation from the standpoint of retention. He would add an axial groove and an inwardly inclined cervical seat to the cavity preparation. Dr. Bronner may be right in theory. I hope he is not in practice, not only because we have inserted some of these fillings in patients' teeth but because we do not like to see a simple preparation become complicated. In order to check up on the rationality of the use of the Willett inlay, we are attempting to follow the retention and service of some of these fillings (a few of them in conjunction with two-surface amalgam fillings in the same mouth) by periodic bite-wing radiograms.

Dr. Floyd Hogeboom³ had quite a little to say in his *Practical Pedodontia* on acolite inlays for children, so we tried acolite. Acolite is a light, low fusing (around 480° F.), silver-colored, tin-antimony-zinc alloy which has but 0.4 of 1 per cent casting contraction. This alloy cast and gave excellent fits with a high-plaster investment and 500° F. burnout. Acolite may have its place in a bulky casting. For these small Willett-type inlays, however, it was too brittle. It snapped off easily on the buccal and lingual extensions of the casting. Hardness tests showed this alloy to have an average Brinell hardness number of 47. A well-malleted, pure, gold-foil filling, by way of comparison, will show a hardness of 65 to 70. Clinical experience with the spreading of these slender inlays would indicate the use of a hard platinum-gold alloy. We are selling services in our practice of dentistry, not metals.

If gold inlays are the ideal two-surface filling but can be used for certain patients only, what shall we use regularly for a filling material? The bulk of our clinical interproximal deciduous molar fillings are silver amalgam. Approximately 50 per cent of the men who were writing on filling materials

for children's teeth last year were recommending copper amalgam. Perhaps I am letting myself in for criticism, therefore, by 50 per cent of the profession for employing silver amalgam.

A sample of the condemnation of silver amalgam was brought along tonight in the shape of a brief from a paper published during the past year:

1. Copper amalgam can be used where thorough dryness cannot be obtained.

2. It will not irritate the gum tissue.

3. It may be placed closer to the pulp than any other filling material.

4. It needs less preparation for retention than other filling materials.

5. It has better edge strength than cements but not so good as silver amalgam.

6. It prevents recurrence of decay because of the germicidal action of the copper salts.

The paper admits that copper amalgam is slow setting and presents a poor esthetic appearance in the anterior part of the mouth. The paper neglects claims of other operators that copper amalgam has no volume change. It concludes with the statement that silver amalgam has no place in children's dentistry, since it cannot be placed close to the pulp, has no germicidal property, is less adaptable to cavity margins, and will leak at the margins with subsequent decay and possible pulp death in an average period of six months.

Most of the observations on the dental amalgams published prior to the year 1928 were based on somebody's opinion, not on research. The research, initiated at the Bureau of Standards, through the financial aid of the American Dental Association has done an enormous amount of good, weaning us dentists away from the inheritance of opinion and quackery which we gained from our barber and itinerant-peddler predecessors. It is enlightening to examine our store of actual facts concerning copper amalgam:

- (1) There are very few conscientious operators today who will agree that any filling material can succeed in a moist, unsterilized cavity. Such fillings, if we may believe the clinical experience of some of the older members of our staff, painlessly devitalize the tooth when copper amalgam is used.
- (2) Copper amalgam may not irritate gum tissue, but the pellets which Dr. C. Merle Dixon* of our school has planted as foreign bodies beneath an experimental rabbit's skin actually produced caseation necrosis. So characteristic was this reaction that it threw some doubt upon the advisability of using copper amalgam as a root canal filling.
- (3) The basis for the claim that copper amalgam can be placed nearer the pulp than any other filling material seems to be the assumption that its thermal conductivity is much less than that of silver amalgam. No one has worked out and published metallurgical tables to show the coefficient of heat conductivity of this material. Actual testing of it is a long, tedious, and highly expensive project. The conductivity of both copper and silver as metals is high and of the same order; that of mercury is quite low. One cannot estimate the comparative coefficients of

*This work has since been published in the *Journal of the American Dental Association* August, 1933, under the heading, "Tissue Tolerance to Foreign Materials" by C. Merle Dixon and U. Garfield Rickert.

the two amalgams on the basis of the combining proportions of each with mercury, since both form new metallic compounds when alloyed with mercury. (4) It has been said that copper amalgam cavities need less preparation for retention. Yet this amalgam has no adhesiveness when packed in a glass cylinder on a glass plate, while a zinc oxyphosphate cement cylinder will resist a distinct pull until it is completely set and dehydrated. (5) There is no such term as "edge strength" known to metallurgists. Strength, in metallurgy, is a composite resistance to several stresses, for example, crushing resistance, resistance to shearing, pulling, compression, twisting, and so forth. If shearing resistance is meant, Dr. John G. Coggan* of our school found that it was necessary to design new lathe instruments to plane off his copper amalgam test cylinders in order to prevent fracturing the ends. Silver amalgam cylinders showed no tendency to fracture with the cutting instruments he already had. (6) The claim for prevention of recurrent caries by the germicidal copper amalgam is undoubtedly true, providing the filling is retained. C. Jane Fraser,⁴ while working on the efficiency of dental fillings at the University of Toronto, found copper amalgam germicidal for fifty transfers over a period of two and a half years. A point not to be overlooked in this connection is solubility. No germicidal material in a dense, set mass will be germicidal unless it goes into solution and, if a substance dissolves, one wonders just how permanent it is going to be as a filling material. These same test cubes of Miss Fraser's showed a 5.8 per cent loss in weight after three months' soaking with five transfers and a 48.0 per cent loss in two and a half years with fifty transfers. (7) The flow of copper amalgam, contrary to the opinion of most of the men who are using it, is practically nil. The first report of Dr. Taylor⁵ from the Bureau of Standards showed a 0.1 per cent shortening in a centimeter cylinder, subjected to 250 kilogram pressure for twenty-four hours. This may be compared to the 5 per cent limit (fifty times as much flow) allowed for an acceptable silver amalgam. (8) Crushing resistance for copper is of the same order but less than it is for silver amalgam. (9) No significant volume change may occur in the mouth where temperature extremes vary occasionally from a spoonful of ice cream to a mouthful of hot coffee, but the setting change of copper amalgam is a *high contraction*. The same Bureau of Standards' report, to which I have referred, picked up setting contractions of 1.5 to 6.0 microns per centimeter in twenty-four hours. Dr. Coggan finds an average twenty-four-hour shrinkage of around 6.0 microns. This shrinkage stopped all further consideration of copper amalgam by the Bureau. Present specifications for silver alloy require a 1 to 10 micron expansion, and this desirable setting expansion might well be raised to 5 to 12 microns. The diameter given for *B. acidophilus*, by way of comparison, is 0.4 to 0.7 microns. (10) Any operator who has read the work published by Ward and Scott⁶ and has incorporated the facts discovered by them in his own office silver amalgam technic, can insert successful silver amalgam fillings in children's teeth. If he will select an alloy not too close to the shrinkage line, weigh the portions of alloy and

*With special permission of John G. Coggan, Instructor in operative dentistry, University of Michigan Dental School; work still unpublished.

mercury, actually time the mix, triturate in the mortar with a pencil grasp on the pestle and a speed of approximately 220 revolutions per minute for forty seconds, mull in the palm of the hand for sixty seconds, and pack this plastic mix carefully into a matrix without expressing the excess mercury at the start, these silver amalgam fillings will last at least six years instead of killing the pulp in six months.

I have no criticism for the operator who is getting results with copper amalgam. So often in dentistry the fault lies not so much with the material that is being used as with the operator who is using it. In our clinic we think that the use of a soluble and shrinking filling material is irrational.

(3) CAVITY PREPARATION

We have seen three succeeding types of cavity preparation used clinically—the old slot filling, the amalgam inlay, and the occlusal step or dovetail preparation. It did not take long to find out that a slot drilled in the side of a child's molar and packed full of silver amalgam was a waste of material, a waste of both the patient's and operator's time, and usually a waste of the patient's tooth.

The amalgam inlay was an adequate filling provided it was properly inserted. It consisted of a saucer-shaped cavity, undercut entirely around the periphery. A matrix was placed, a drop of zinc oxide cement of the consistency for setting an inlay was wiped on the axial wall, and the amalgam was immediately packed into the plastic cement. To keep such a cavity dry, to keep the matrix in place and to get both cement and amalgam mixed at the same time was too complicated a technic for the dentist without an assistant. A cement line was fatal to the life of the filling and so was a fracture of thin buccal or lingual enamel margins.

It was plain that there could be no short cuts in cavity preparation even for a child. The standard adult preparation was adopted with a proximal box and an occlusal surface dovetail. Realizing that the cervical enamel of the deciduous molars usually terminates abruptly in a heavy, pronounced, deflection ridge, we are not attempting a square angle at the buccocervical and linguocervical corners of our preparation. Rather, we are leaving these corners rounded to prevent the accident of having a cervical floor suddenly disappear beneath the bur. It is quite true that the deciduous pulp chambers are proportionately larger (so far as radiographic evidence is concerned) than adults' pulps. A dovetail adequately seated in dentin for retention, however, will rarely expose a horn of the pulp.

A word about instrumentation may not be amiss at this point. A deciduous molar with an incipient interproximal cavity usually presents an occlusal surface of solid enamel. We are teaching the use of moist stones to gain access to these cavities. The smallest inverted-cone-shaped knife-edge stone can be used to nick through the marginal ridge enamel and expose the cavity on the proximal surface. A similar nick can be cut parallel with this first nick through to dentin in the nearest sulcus. A nick can then be made connecting these two initial cuts. This allows burs to be started directly in

dentin and expedites finishing the outline of the cavity with short-shank inverted cones followed by a short-shank No. 557 or No. 558 cross-cut fissure bur. Thin buccal and lingual proximal margins may be chiselled off square with a medium-sized pair of enamel hatchets and a buccocervicolingual-axial retention groove cut inside the proximal surface with a No. 1 round bur.

The Ivory No. 8 matrix and retainer seem to work the most successfully in my hands. The invention of a matrix which could be tightly adjusted to the contour of a deciduous first molar without slipping off or hurting the child's gum would be welcomed by most men working for children. The No. 8 matrix has to be trimmed down much narrower, of course, before it can be used on a child's molar.

Packing should be done with small instruments to make sure that the proximal margin is tightly condensed. The surface of the filling should be moist with mercury as new portions of amalgam are added and this excess removed from the final occlusal packing. Spoon excavators, followed by burnishers, are usually sufficient to carve the occlusal anatomy of the average deciduous molar. We are making it a rule to polish all amalgam fillings at a second appointment.

FURTHER PROCEDURES AS TREATMENT IS DELAYED

To carry this discussion to a logical conclusion one would have to describe further procedures necessary to care for teeth when treatment is progressively delayed and prognosis of a successful operative outcome becomes progressively poorer. An interproximal cavity approaching the pulp is the next stage in the destruction of deciduous molar when prevention fails or treatment is postponed. This stage is followed in rapid succession by the exposed pulp, the acute abscess, putrescent root canals, extraction and finally by space maintenance. Our further procedures can only be outlined.

(1) CAVITY LINING: PULP CAPPING

Most of the obvious proximal cavities in a child's mouth are going to need some sort of pulp protection. To date, I have been relying upon ammoniacal silver nitrate reduced by eugenol to sterilize the dentin, and upon a zinc oxyphosphate cement base to prevent thermal shock. I have been trying out a mixture of zinc oxide thymol iodide (aristol)—powdered silver nitrate and oil of cloves as a cavity liner or treatment cement for a deep sensitive cavity on the child's first visit. I am also using a combination liquid of Canada balsam and oil of cloves with the same powder as a cavity liner. I hope eventually to decide on a cement for this purpose which will set fast, sterilize discolored but sound dentin, act as a sedative to the pulp, be a nonconductor of thermal shock and still not stain the tooth. I am not relying upon any expensive, mysteriously compounded trade product of some "Hokum" specialty company to cap pulps and I am not afraid to use C. P. drugs, put up by any reputable drug company, for fear they will not be chemically pure.

A great deal is yet to be learned about cavity sterilization and the effect of germicidal cements upon a tooth. Our old, time-honored routine of phenol alcohol sterilization seems to be an inherited procedure, since a separate com-

mittee of the American Association of Dental Faculties has been trying, I understand, to determine what constitutes adequate sterilization of a cavity. One cannot help wondering why a cavity needs a germicidal cement lining if the cavity is tightly sealed by a nonsoluble filling and really sterilized before being filled. Unless there is sufficient circulation in the dentinal tubuli on the cavity side of the cement, how will the germicide it contains get into solution and become effective? Bodecker and Applebaum⁷ think there is sufficient circulation in the dentin to harden and improve the dentin by diffusion when it is in contact with an oxyphosphate cement.

For several evenings this winter I have been preparing with Dr. Dixon pellets of zinc oxyphosphate cement, red copper cement, black copper cement, and germicidal silicate cement. These pellets are to be planted under the skin of a series of rabbits to determine their tissue reaction and the inhibition they show toward a streptococcal infection. Whether the results of this experiment will throw any light upon what these same cements will do in a tooth cannot be answered but may be worked out later.

(2) EXPOSED PULPS

My efforts to cap an exposed pulp have so uniformly resulted in an abscessed molar that I have stopped trying to cap the pulps of deciduous teeth. My routine treatment is devitalization, removal of the coronal portion of the pulp, and insertion of a filling over a sedative paste in the pulp chamber. I have tried pulpotomy of the living pulp, using novocain anesthesia. That procedure will work; but most children object strenuously to the injection. Low pressure anesthesia is also painful in my hands. Arsenic devitalizing paste or fiber is being used successfully by a number of practitioners. I am not using arsenic because of the chance of its escaping from under the sealing material or out through a resorbed root end.

I am at present sealing in a polymerized formaldehyde paste under cement for one week; amputating the coronal portion of the pulp; filling the pulp chamber with a creamy paste of root sealer powder* and glycerin and iodine liquid and putting in a cement base and amalgam filling immediately. (Glycerin of iodine may be made by warming 10 to 12 grains of iodine crystals in an ounce of glycerin on a water-bath.) This technic eliminates pain; it is simple and safe; it does not involve attempting to insert a root canal filling down the tortuous ribbonlike root canals of a young deciduous molar. The time consumed will be approximately ten minutes to seal a treatment and forty-five minutes to amputate the pulp and fill the tooth. The field must be kept dry and sterile.

The formula for the desensitizing paste I am using is one of Dr. Hermann Prinz's⁸:

Trioxymethylene (paraformaldehyde)	15 grains
Thymol (crystals)	15 grains
Zinc oxide	30 grains
Glycerin q. s. ad a stiff paste.	

Powdered asbestos was added to this mixture to give it body, and carmine powder was used to give it color.

*This powder is used in Dr. U. G. Rickert's root canal filling technic.

Until we have followed a series of these pulp amputations radiographically, from the time of treatment until the time of exfoliation of the teeth, this procedure must be considered empirical. Two- and three-year check-ups and the normal exfoliation of these teeth with roots entirely resorbed make me think, however, that I am securing quite flattering results.

(3) ABSCESSED AND PUTRESCENT PULPS

I have not followed sufficient treatments of selected abscess and putrescent pulp cases for me to say much about my treatment. Having in two instances since I began practice, seen abscessed deciduous molars contribute to a nephrosis and a heart murmur, I think these cases require a careful diagnosis.

(4) SPACE MAINTENANCE

When a deciduous molar has to be extracted and measurements show that the space is closing, I construct a Willett⁹ type cast overlay space retainer. I like this method of retention because it holds space adequately, restores function, involves a casting rather than a soldering technic, and does not have the tendency to loosen up frequently and injure the gingival tissue about the abutment teeth. I should welcome a simpler constructed retainer which would do all these things for me.

In a space retainer we are not much concerned about the space growing longer. Sheldon Friel's¹⁰ measurements show a combined mesiodistal width of the maxillary deciduous molars and canine 1 mm. wider than that of the permanent premolars and canines. The same combined mandibular deciduous measurement is 2 mm. greater than the permanent.

I was criticized recently, however, because the space retainer I have been advocating with a rest on a shelf of the anterior abutment casting was interfering with lateral growth in the canine region. I had the idea, previous to this criticism, that lateral growth of the arches in the canine region was synchronous with the growth of the first permanent molar region. A search of the literature finally located a paper by Lewis and Lehman¹¹ of Detroit reporting lateral arch growth of a limited number of Merrill Palmer School children.

Their measurements for the period of growth between five and nine years of age show the average total lateral growth of the maxillary deciduous canine region as about 2.5 mm. greater than the lateral growth of the maxillary deciduous second molar region. Similarly, the mandibular canine region exceeds the mandibular second molar region by a little over 0.5 mm. This information caused me to change the design of my space retainer to an L-shaped bar dropping through a ring of at least 1.25 mm. inside diameter for the maxillary arch, smaller for the mandibular arch, to allow for increased lateral growth of the canine region.

By way of conclusion let me say that practicing dentistry on the basis of research and clinical observation is rational dentistry; practicing dentistry on the basis of tradition is empirical dentistry; buying a four dollar trade-marked specialty that we could have had compounded for twenty-five cents by a competent pharmacist comes close to practicing "Sucker" dentistry.

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ORTHODONTIA AND ITS RELATIONSHIP TO MEDICAL ANOMALIES

LEONARD KOHN, BROOKLYN, N. Y.

ORTHODONTIA is a study of growth and development, to determine those factors which aid in bringing about the normal development of the dental arches and the functional perfection of the teeth and their correlated parts, and it strives to learn the influences necessary to maintain these conditions when they are once established. So, although orthodontia has been defined as "that science which has for its object the correction of the malocclusion of teeth," I must go still further to quote a definition which coincides more with my view of its purpose, "that mechanical means of stimulating those biologic and physiologic processes which in turn make possible the normal development and functional perfection of the teeth, correlated soft tissues and investures, and the appearance of the patient."

In order to comprehend fully any problem presented in orthodontic treatment, it is necessary to consider the body as a whole in its relationship to this dental anomaly. A patient is entitled to the broadest survey of the body that can be given so that any attending condition to a narrow or overdeveloped arch and crooked teeth might be corrected before mechanical interference is proceeded with, because orthodontia uses mechanical means to an end just as orthopedics does. As it is neither the province nor the duty of the orthodontist to render a general diagnostic service to the patient, it is a paramount duty to keep in close touch with the physician to attain the greatest amount of good for that patient in that particular case. The physician's report will constitute a more valuable record of the etiology of any case than the meager observations of the orthodontist, thus enabling the physician, the dentist and the orthodontist to collaborate in a scientific manner to the best advantage.

As the dentist and orthodontist can help the patient by observing the need for medical or surgical interference, so too can the physician aid the patient by recommending dental or orthodontic interference. To do this, there is need to develop that diagnostic acumen necessary to recognize the cause before any corrective measures can be instituted.

We, as orthodontists, put these causes into three classes: (1) inherited, i.e., those transmitted with the union of the male and female germ cell at fertilization; (2) congenital, i.e., those existing before birth; and (3) acquired, i.e., those influenced between birth and death.

It has been my experience that there has been a great tendency both by physician and by orthodontist to believe that any emphasis upon causal heredity leads to pessimism in therapy and that emphasis on causal environment leads to optimism in therapy. There is really nothing to be gained by being afraid to look reality in the face because, if heredity is important in etiology, we must endeavor to detect it and utilize that knowledge for finding suitable environ-

mental influences as remedies or as preventives. Then, too, nervous influences, endocrine influences, and metabolic influences depend fully as much on heredity as they do on environment.

In our etiologic studies we pay attention to general constitutional disturbances, as rickets, abnormalities of the lymphatic apparatus, especially tonsil and adenoid growth, endocrine disturbances, nervous diseases, and infections like syphilis and tuberculosis. We pay strict attention to the effect of dietetic deficiencies, particularly vitamins, and their effect on the structures in which we are interested. We watch the calcium and phosphorus content of the blood and call on the physician to make tests for us. We look to the obstetrician to help us combat prenatal influences in regard to calcium and phosphorus deficiency and faulty positioning of the fetus in utero. We are learning more of faulty habits such as thumb- and finger-sucking, tongue, lip, and cheek biting, abnormal movements of the parts mentioned, and abnormal postures assumed during sleep and while awake which might change the size and shape of the sinuses.

So, in a hasty manner I have given a résumé of the etiologic factors which an orthodontist considers, any one of which would be a fit subject for voluminous discussion.

I shall call the attention of the rhinologist to the relationship of mouth-breathing to malocclusion. Does the faulty development of the oral and nasal cavities and accessory sinuses cause malocclusion, or is it vice versa? Many septums have been deflected and subsequently removed because of lack of development of the floor of the nose, causing the septum to buckle; whereas had the orthodontist caused the roof of that mouth to develop, the deflection and subsequent removal of that septum might have been avoided. It is not necessary to call your attention to the fact that the bones that form the roof of the mouth also form the floor of the nose.

Adenoid growths and enlarged and infected tonsils often are removed to correct or eliminate mouth-breathing only to find that the condition still persists. The cure might be found in subsequently subjecting the child to orthodontic treatment with a re-education of the patient in nasal breathing. I find too that the average mouth-breather presents a chest deformity due to lack of function of the area. It also follows in cases of labored nasal breathing due to the above causes with the addition of nasal polyps, which in itself is a cause.

In the field of otology—deafness caused by the protrusive growth of the mandible is sometimes relieved and cured by the proper placement of that bone in its relationship to the skull at the temporomandibular articulation. The involvement of the facial nerve in middle ear conditions causing paralysis of the muscles of expression, would upset the stability of the dental occlusion because of the lack of functional control of those muscles. An orthodontist would be of some aid in helping maintain occlusion if he were consulted.

Of the endocrine disturbances, hypothyroidism is frequently associated with delayed eruption of teeth and with their malposition and absence, and the thyroid controls, mental and physical growth. Hypoparathyroidism leads to faulty calcium metabolism and other tooth defects, the parathyroid being

the calcium control gland for the bone growth. As excision causes death, the toxic symptoms must be recognized and destroyed and deficiency of function corrected. The thymus body being a stimulating gland for the calcium control for bones and lymphatics, it has its greatest influence from birth to puberty, and must be considered seriously. All others might be mentioned with special consideration to the pancreas, the imbalance of which causes diabetes.

Dr. C. C. Howard of Atlanta has made an exhaustive study of the endocrines in relation to orthodontia. After radiographing thousands of patients to observe the bone developments over a period of five years, in conjunction with a competent staff of specialists in all other medical branches (he being the orthodontist on the staff), he presented his report as only a query without any conclusion. They believe that bone is a better gauge of development than any other sign. They have found that the development of the pisiform bone in the hand serves as a very excellent index of the development in other parts of the body. He also believes that the overstimulation of the pituitary gland can lead to the overdevelopment of the mandible. There is no doubt that the other endocrines will subsequently find their places in the entire scheme of bodily development and bodily disturbances. Much fine research work is being done along this line.

This naturally leads us to a survey of the metabolic and vitamin studies in relation to malocclusion. We must consider rickets, scurvy, and the disposition to infections related to the deficiency of one or the other of the vitamins. Study of the blood content for calcium and phosphorus must be instituted, which would necessitate an inquiry into the diet of the patient for vitamin control. And so I could go on and on.

Nervous habits of children have been referred to previously as a cause of malocclusion and facial deformity, but there might still be a neurotic constitution which needs medical care and supervision. A child growing to puberty might suffer an inferiority complex because he has a peculiar appearance due to a severe malocclusion, which in turn might deleteriously affect his entire life and development.

The orthopedist has great occasion to learn of orthodontic procedure because so often in my work I come across an accompanying condition of flat feet. Lateral curvative of the spine is not wholly uncommon. In the latter instance the plaster casts that are placed on the young patient for the correction of the condition without any doubt shorten the lower third of the face by depressing the molar teeth and changing the angulation of the mandible. I believe an orthodontist should be called upon to institute preventive measures while treatment is being carried on.

In conclusion I make a plea for the closer relationship of the physician, the dentist, and the orthodontist because we have so many problems that are of interest to all of us.

EXAMINING THE CHILD

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IT HAS been said that "the child of today is the man of tomorrow"; thus the dental examination is of major importance. The little patient too often receives a look, and a promise, and is sent out into life with a serious handicap as the result of our failure as doctors of dental science to have seen the light. The general practitioner who graduated ten years ago has no fundamental training in children's work, and if he fails to attend dental meetings and to read the literature, is lost in this field. Many men find it not only uninteresting but not profitable and would rather spend their time with adults. The child in the small community is the unfortunate one, for he has no one else to give him the necessary service. How many children have weakened hearts, kidneys, and other secondary sources of infection because they were not given the proper examination and service? How many die early in life because of a focal infection? The examination is a very serious matter, and the findings are of utmost importance to mother and child. The patient is developing physically and mentally and should not be weakened by a focal infection. He should be free from any such disorder so that he may have a chance in life equal to that of others.

Many times school boards and superintendents fail to recognize that a child may be handicapped physically. Some schools will not dismiss a pupil for a dental appointment. This often may be traced back to the local dentist or dental society. Many large school systems have nurses, who on the whole are most incompetent in making dental examinations. They resort to the tongue depressor, have the patient open his mouth, and with a glance dismiss the patient without a satisfactory inspection. The school dentists usually have so many to see in such a short time that they are unable to make an adequate examination. The children's cards are marked Ok, and their parents are for the present well pleased. It is not until little Johnny develops a toothache that he is taken to the family dentist. The mouth is thoroughly examined and reveals, much to Mother's surprise, that Johnny has six or eight cavities.

A short time ago a youngster, aged ten years, came for an examination. The history revealed that two infected mandibular deciduous molars had been removed two years previously. The patient complained of an intermittent dull pain in this region. The parents had taken the boy back to the dentist who had removed the teeth. The dentist glanced at this region and informed them that probably the permanent teeth were trying to erupt. The parents, not satisfied with this diagnosis, came for further information. X-ray pictures were advised and as the intraorals did not cover the field, an

extraoral was taken. The radiogram showed a large cyst extending from the mesial root of the first permanent molar to the deciduous canine. The two premolars had been displaced, leaving the permanent canine and the first permanent molar questionable. This case shows what might be left in any child's mouth if the examiner is in a hurry.

Now the question arises, when should the examination be given? If there is no difficulty in the eruption of the deciduous teeth, the patient should be seen thereafter every four to six months as the operator desires. When a new patient comes to the office, there should be a thorough examination upon the first appointment, not upon the last one.

The first consideration is to gain the child's confidence. The appearance and the actions of the child as well as of the parent often tell a great deal. The types of children must be noted, whether they are normal, spoiled, or timid, as well as their age and physique. With these factors in the immediate background one proceeds to learn the child's name. If the patient is responsive ask him all the usual questions, such as what is his name and how does he spell it. The patient, having had no previous work, should be introduced to the mirror, the explorer, and other instrumentation, allowing him to see and feel them. A little explanation should be given the child first, so that the insertion into the mouth will be less difficult. Older patients, having experienced this procedure, are usually more receptive and open their mouths when approached.

The general condition of the oral cavity should be observed, and it should be noted whether the mouth has received any attention. This will inform one how to proceed with the patient and the parent. If the child has had poor dental work or little care, one will certainly have to approach the mother differently than if the work was excellent or the mouth was well kept.

The operator must have a knowledge of the fundamental sciences, embryology, physiology, histology, pathology, and anatomy, so that a complete examination can be made. One must know the periods of eruption, calcification, and resorption in order to make a diagnosis. Keeping these factors in mind one should examine the soft tissues of the mouth. Gum-boils which are external manifestations of a periapical abscess should never be missed. The appearance of grayish white patches or bleeding hypertrophied gums requires a bacteriologic examination. Vincent's infection is often found in the entire family. There are many other tissue infections, and one should not hesitate to consult a physician when in doubt on any lesion. The presence or absence of a coating upon the tongue should be observed. If the tongue is coated, there is an indication of a digestive disturbance, possibly an acute or chronic condition. Next, after thoroughly drying the immediate field, the teeth should be observed. A sharp double end explorer and a mirror are indispensable in testing grooves and pits for defects. Dental students, making such an examination, too often present one with a dull explorer for the check-up on their findings. Many of them glide over the majority of the small pits, and miss all but the large ones. It is interesting to ask them

for a sharp explorer and then find from 40 to 50 per cent more cavities. The time to train dentists is while they are in school, and this important phase of the training has been sadly neglected by many.

Some time ago a student asked to have his patient checked and seven additional cavities were found. He was informed that it was most disappointing to find such a condition. His immediate excuse was that he was in a hurry to attend another patient. No man who takes the responsibility of examining a patient is justified in such an excuse. What is going to happen to the little patient he has just seen, and what is he going to do out in practice?

The incipient interproximal decays are often puzzling and a cavity cannot be confirmed without the aid of an x-ray examination. Many times the only evidence is a translucent marginal ridge. It is much more difficult to detect an incipient interproximal decay in deciduous molars because the contact is so much wider. X-ray pictures are indicated in practically every case and should be used much more than they are at the present time.

The depth of the cavity should be considered while exploring the mouth, and the cavities should be charted as to position. The number of teeth that are vital and nonvital should be recorded. The application of the ice and the heat test for vitality has little merit in deciduous teeth. The expansion and contraction of the pulp cannot be successfully determined when the teeth are absorbed at the apical end. External evidence, exploration, percussion, and the x-ray picture are the determining factors as to vitality.

The following, too, are important points for considering in every case: the number of teeth lost in the arch, normal or abnormal development of the arches, and the amount of space between the anterior deciduous and permanent teeth. The spacing of the teeth is of great importance to the child patient. If the space is insufficient in the deciduous anterior teeth, the permanent teeth cannot erupt properly; likewise, too much space between the permanent central incisors probably indicates too large a phrenum.

The case history is often beneficial and should be tabulated. A statement concerning the general health and any information relative to the patient will help to serve him better. It is always interesting to get the diet program, which often seems to tell us the whole story.

The examination of the child is never complete without an adequate record of the findings. The chart as seen in Fig. 1 was designed in our department and has been used for the past two years. The arrangement of the card is as follows: *A* is used for the class of cavities; *B* is the number of open cavities; *C* is the number of fillings already in the teeth; *D* is the fillings placed by the student; *E* is space where remarks are written about any history such as the birthday and the health findings; *F* is the kind of filling to be placed. The opposite side of the card is used for additional information. The alphabetical letters represent the deciduous teeth and the numbers the permanent teeth. This record enables one to find the average number of cavities and fillings for any tooth at any age. With the aid of a large number of

charts it may be of some value and interest to see graphically how decay and loss of the teeth progress at different ages.

The number of cases checked thus far with these cards is not large enough to report any findings. The chart recently presented by Dr. F. B. Rhobotham and his committee is much more adequate. It is a chart that should be universally adopted and used in all institutions and practices.

The survey which the U. S. Public Health Service is conducting is very beneficial to dentistry. It will help to instill in the minds of the school children and their parents the need for dentistry. However, it will be impossible for the Public Health Service to have any accurate data as to the actual condition. The examination does not specify whether it should be made in a dry or wet

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Fig. 1.

field. Many school authorities will not allow enough time for an adequate examination, and many examiners are not interested in accurate data. The Public Health Service, however, should be highly praised for its efforts and the good it will do for dentistry.

The type of examination and the interest in each individual case cannot help but affect one's practice. The sincerity and thoroughness of one's work will certainly impress the patients. The laity comes to the dentist with confidence, and there should be no doubt in the patient's mind as to the interest and honesty of the practitioner. It is imperative that the dentist should have a good background in the fundamental sciences. The examination and correct diagnosis play a large part in the failure or success of any case.

CASE OF EDENTULOUS CHILD

CHARLES B. BRAY, D.D.S., BIRMINGHAM, ALA.

THE child, a boy, was born April 9, 1922. The delivery was normal and there was nothing abnormal about the appearance or general condition of the baby at time of birth and for some time thereafter. He was first seen when nearly three years old, at which time he was brought to the clinic of

Fig. 1.

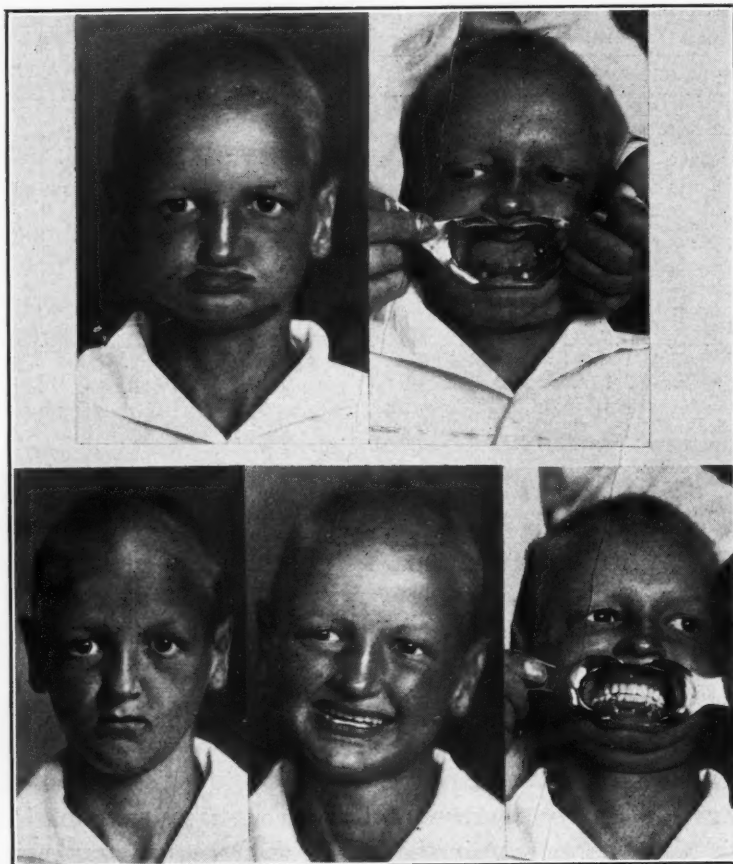


Fig. 2.

Fig. 1.—Appearance of patient before wearing plates.

Fig. 2.—Appearance of patient wearing plates.

the American Cast Iron Pipe Co. for examination. He was then acutely ill, having a temperature of 102° F., and having bilateral suppurative otitis media and moderate cervical adenitis. The tonsils had already been removed.

It was at once noted that he had no teeth, and this defect gave the child the appearance of an old man. After subsidence of the acute illness which caused him to come under observation, the case was studied in detail. The

father had always been in good health except for occasional attacks of acute sinus infection. The mother, who was also still living, had been in good general health but had had four miscarriages and had been operated upon several times for gynecologic conditions secondary thereto. Neither parent gave any history or showed any signs of lues and both their Wassermann tests were negative.

Examination of the child showed a complete absence of teeth, and the x-ray examination indicated a complete absence of tooth buds. The parents stated that no teeth had ever erupted prior to the time he was brought to the clinic. In addition to being edentulous, the child also showed a small umbilical hernia. The case has been followed, and the patient has been kept under continuous observation since he was first seen. In regard to his general systemic condition, the child progressed normally except that he showed a rather unusual susceptibility to respiratory infections, having had pneumonia once and acute influenza complicated with otitis media on several occasions. It was also difficult for him to eat a full and balanced diet appropriate for his age because of the lack of teeth. Numerous x-ray examinations were made from time to time, to see what, if any, signs of tooth development could be found. At the age of four years, two canine teeth, one in each side of the mandible, erupted. No other teeth have erupted since, and no signs of tooth buds have appeared in the x-ray pictures taken from time to time. The child seems unquestionably to be destined to be permanently edentulous except for the two canine teeth that appeared at the age of four.

When the child was thirteen years of age, after I was convinced that he would probably have no other teeth, I made an upper and lower denture for him, both for cosmetic reasons and to enable him to eat a wider variety of food and to chew more normally. He is now wearing the plates with increasing satisfaction. He has gained fifteen pounds since beginning to use them, and they have improved his appearance remarkably, as Figs. 1 and 2 show. He has also shown a marked improvement in his school work.

It is interesting to note that the parents have another child, born three years after this boy, whose teeth show nothing abnormal.

GROWTH AND DEVELOPMENT IN ITS RELATION TO CHILDREN AND ORTHODONTIC PROBLEMS

H. L. SPINNEY, D.D.S., SANTA BARBARA, CALIF.

DURING the last decade the mechanical side of orthodontia has reached a very high degree of perfection. Constant improvement is being made in the simplicity and efficiency of the regulating appliances; the skill of the operator in the manipulation of these appliances is reaching a much higher plane, yet the number of successful end-results in proportion to the number of cases treated is far from satisfactory.

I believe, as do many orthodontists, that the biologic factors are the basic causes for some, if not all, of the malformations existing in the mouth. However, I do not believe that very many orthodontists are availing themselves of the opportunity to utilize the biologic knowledge furnished by research workers to assist them in the mechanical manipulation of the teeth and osseous structure of the jaws.

The lack of normal response of bone and teeth to mechanical stimulation, the inharmonious alignment of jaws and teeth to the facial contour, the length of time necessary to hold the teeth in position with the retaining appliances, in some cases the inability to fixate the teeth after they are in alignment, and root resorption are some of the conditions with which one comes in constant contact. In the past, these have been accepted as conditions that could not be controlled; but now, through our increased knowledge of certain fundamentals in diet, endocrinology and light therapy, they could be overcome by application of this knowledge, and the percentage of failures would be greatly reduced.

We are all seeking the ideal, and the sooner we realize that the factors controlling the growth and development of the skeletal structure also control the growth and development of the jaws and teeth, the sooner we shall reach our goal. The histologic structure of the component parts of the oral cavity is such that any influence which will cause a disturbance in growth and development will be registered there very forcibly. The resultant effect of local influence depends upon how this disturbance reacts upon growth, development, and mineral metabolism.

Therefore, it may be readily seen that orthodontic problems are not merely mechanical, but are also problems of growth and development.

To delve deeply into the basic causes of malformation, we must delve deeply into the factors which control growth and development, namely, diet, glands of internal secretion, and ultraviolet ray. These deformities go deeper than mere oral disfigurements; they are really secondary symptoms, from which a primary diagnosis could be made if we would interpret them correctly. While the correction of these local conditions is imperative, it is much more imperative that we learn to recognize and diagnose the basic causes creating these mal-

formations. Believing that these different types of malformation are created from known causes, which I feel can be anticipated, would we not be rendering a much greater service to humanity if we would attempt correction by assisting nature to attain normal growth and development? This would help us gain the harmonious relationship of the oral cavity with the rest of the physical structure.

The additional benefits the patient will receive are many, and the increased services rendered will be a constant source of satisfaction to all concerned.

The clinical evidence of an imbalance of the different glands and the influence of diet are registered in the mouth by various symptoms. The different teeth affected, different types of malformation, different types and densities of the osseous structure are all registered there and give us a clue as to the time of the unbalancing of the factors controlling mineral metabolism, growth and development, whether the condition is congenital or acquired, and in many cases the specific cause.

The influence of diet on mineral metabolism, growth, and development is probably best explained by this short quotation from Draper: "It is hard to conceive that simply the provision of nutriment accounts for growth and development, without nourishment these phenomena would not take place. But there is something inherent in animal cells which drives them to divide, multiply and differentiate into special organs."

Cavitation, impactions, types of malformation, the growth rate of the teeth in correlation to the growth of the skeletal structure, the time of exfoliation of the deciduous teeth and the eruption of the deciduous and permanent teeth, are all diagnostic symptoms indicating whether or not the glands of internal secretion are in normal balance. All glands of internal secretion influence every case of malformation either directly or indirectly through their control of metabolism and growth; and the conditions that they create, if recognized and corrected, will materially assist the orthodontist in bringing his case to a successful conclusion.

Quoting Dr. Englebach: "The thyroid hormone component to the unfertilized ovum and sperm is an important factor in governing the perfection of its subsequent differentiation into the embryonic ectoderm, mesoderm, and endoderm. A sufficient supply of thyroxin to the fertilized ovum is necessary for development of these fundamental layers into the bodily organs. This tissue differentiation occurs chiefly during the first two months of embryonic life. Hence, the adequacy of thyroid hormone at that time is most essential.

"The three biologic phases of the physiologic evolution of an individual are (1) primary tissue differentiation, (2) somatic growth and function, and (3) the end-result of these two phases, reproduction. The first phase, that of differentiation, is chiefly influenced by thyroid function. Normal thyroid activity provides the cellular essentials from which are developed the more complex tissues of the body. The second phase of somatic development is controlled almost entirely by the hypophysis, which supplies to the body its most important incretions productive of growth and furnishes the internal secretions which provoke gonadal activity at puberty. The gonads, after puberty, provide an incertion which unites the epiphyses, preventing a continuation of development

which has then arrived at maturity and is biologically prepared for reproduction. . . . Concerned with the above divisions of biologic effects, the incertion from the thyroid gland will be regarded as a primary differentiating and secondary developmental hormone; the hormones from the hypophysis, as the primary growth or developmental and sex-provoking hormones; and the gonadal secretions, as primarily inhibiting the growth hormones and being affected secondarily by other hormones."

If, during the formative period, all the factors which influence or control mineral metabolism, growth and development are functioning normally, if we have sufficient material with which to build, we should have normal teeth and normal arches harmonizing with the facial contour.

To obtain a clear picture one should familiarize oneself with the uniglandular and biglandular disorders of the thyroid and pituitary, which affect mineral metabolism, growth and development, and are more apparent during the formative years.

Englebach: definition: "Congenital hypothyroidism is an inherited inactivity of the thyroid gland, presumably due to a decreased supply of thyroxin to the fetus, resulting in a deficient prenatal differentiation and consequent postnatal development and function of body tissue. Clinically it is characterized by a defective mentality and retarded somatic growth, associated with various organic and systemic abnormalities."

Hoskins: "The chemical processes of the body upon which growth and function depend are stepped down to little more than half the normal rate. This metabolic slowing may affect the body weight in either of two ways. If interference with the activity is a predominating feature, more food may be eaten than is burned up and the subject become obese. The over-weight thus set up is aggravated by a tendency of the tissues to become sluggish and waterlogged. On the other hand, the constructive functions may be so depressed that the body wastes away, the tissues simply failing to assimilate sufficient food. Muscular activity is retarded in either case. The reparative processes of the body are defective and wounds or fractures heal slowly. Blood formation is commonly depressed leading to a condition of anemia. Correlated with the tissue sluggishness is a diminished use of oxygen giving a lowering of the so-called metabolic rate."

Hoskins: extreme conditions: "The teeth are slow in appearing and have little vitality; even with good dental care they are frequently lost. The bones of the head and face develop at disproportionate rates leading, among other things, to a marked depression of the root of the nose giving it a characteristic 'saddle shape.'

"Partial deficiency results in different combinations of the feature mentioned and in various degrees of completeness. According to the recent work of Topper, such deficiency may cause fairly marked mental retardation and physical underdevelopment in the absence of any of the other signs of childhood myxedema. In particular, and deceptively, the basal metabolic rate may be recorded as normal. The part played by thyroid deficiency in such cases is revealed by the acceleration of growth, bone development and tooth eruption that ensue when thyroid substance is administered."

Hoskins in speaking of gonadal deficiency during growth and development says, "The growth zones of the bones remain open and the long bones continue to increase in length even well into the third decade. Thus, as a rule, the subjects are unusually tall. The bones are slow, too, in acquiring their adult proportions of the mineral elements, lime, and phosphorus."

The inability of the thyroid to adapt itself to the different stages occurring during life is one of the many things for which we must be constantly on guard, and is more likely to manifest itself during the periods of adolescence, pregnancy, lactation and the menopause, also conditions wherein there are toxemias, dietary deficiencies, especially minerals, over a long period of time.

Many other authorities give us the same picture in regard to the dysfunction of the thyroid and pituitary as to growth and development. Correlating the effects of the dysfunctions of these two glands, thyroid and pituitary, with the malformations found in the oral cavity, we find the following results: Class I malformations are due, I believe, to a congenital hypofunctioning of both the thyroid and the pituitary. In this class of malformation, I believe we will find the slow response of the osseous structure to mechanical stimulation, delayed eruption of the permanent teeth, delayed exfoliation of the deciduous teeth, lack of density of the crowns of the teeth, progressive decay, and slow repair of the osseous structure. In these patients we, as a rule, find retarded physical growth and development along with many other symptoms of the inactivity of the thyroid and pituitary.

Class II malformations: As a rule, there is a hyperfunctioning of the pituitary, and in most cases a lack of thyroid stimulation. This condition may be either congenital or acquired, and to a large extent the osseous structure is influenced by a diet deficiency. In these mouths, as a rule, we find large, well-shaped teeth, more than normal spacing, hyperplastic osseous structure due to rapid growth and low mineral contents, creating an osseous structure that is very susceptible to local influences, root absorption, etc. It is in these mouths that the orthodontist gets a very rapid response to mechanical stimulation, but has difficulty in fixating the teeth after he has them in alignment. Here it is that the knowledge of calcium and light therapy is invaluable.

Class III malformations: My belief is that this condition is entirely congenital. Here we find, as a rule, an overgrowth of the skeletal structure, with all the clinical symptoms of a hyperactivity of both the thyroid and the pituitary, during the first few years of life. Then, due to some inherited tendencies, the thyroid reverts and becomes, to a more or less extent, inactive, causing the growth centers of the extremities to progress at disproportionate rates. The fact that this condition is existing in the growing and developing child before the inhibitory factors from the gonads exert their full influence, does not give us the typical picture of acromegaly with the characteristic symptoms that we find in adults.

As the large majority of cases are Class II malformations, which seem to give the orthodontist the most trouble, I have chosen them as the major topic of this paper.

Let me again call your attention to the conditions we so consistently find in this class of malocclusions: root absorption, abnormal spacing of the teeth,

hyperplastic osseous structure, rapid response to mechanical stimulation and probably the most serious, the inability to fixate the teeth after the orthodontist has established normal relationship. The hyperplastic condition of the osseous structure causing this last condition is due to a lack of mineral contents necessary to stabilize the supporting structure of the teeth. Therefore, some knowledge as to remineralization of bone is necessary.

The osseous structure is composed to a very large extent of inorganic matter, chiefly a combination of calcium and phosphorus.

While I do not mean to overlook or slight the other inorganic matter necessary in normal mineral metabolism, their amounts and the rôle they play in the process of ossification are very small and more or less indirect.

Calcium and phosphorus seem to be by far the most necessary minerals for proper body requirements, and in several respects they occupy a peculiar position among the inorganic metabolites of the body. They form the rigid supporting structure of all osseous structure. They have a peculiar influence upon the excitability of the nervous system. They are indispensable for the normal clotting of blood. They are involved in the metabolism of soft tissue, nerves, heart and cell functioning. They are a big factor in keeping the acid alkaline balance of the tissues. They help to overcome certain toxic conditions. In view of these essential facts, it is necessary to take into consideration their mode of assimilation, utilization, retention and elimination, as well as the known factors which control mineral metabolism, diet, light, and the hormones from the ductless glands.

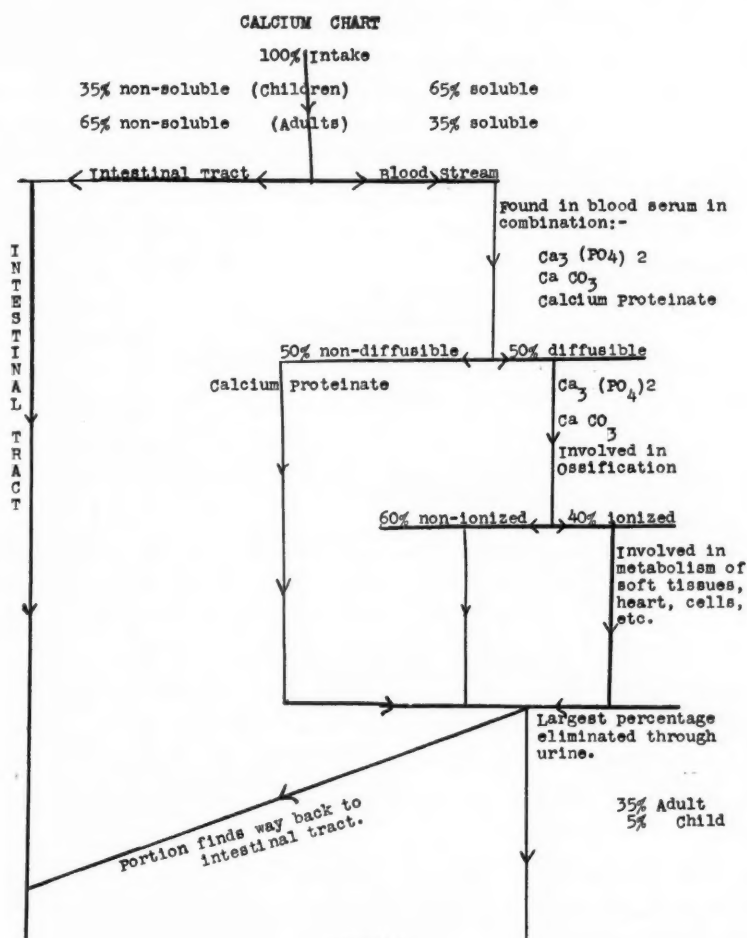
In normal bone and tooth structure, we find calcium salts deposited in an orderly manner. This deposition is carried on by both diffusion and precipitation. In bone and teeth, as in other tissue, during the growth and development period, which is characterized by the most violent production of tissue, we have a great preponderance of anabolic over catabolic activity. It is during this period of growth and development that nature makes its greatest demand for material with which to build.

The great mass of the body's calcium is in the skeleton. We find comparatively small amounts in the soft tissues of the body where it appears to be in combination with the tissue colloids. Under ordinary circumstances normal adults live in a state of calcium equilibrium. The daily intake is balanced by the daily loss. In adults or growing children with a sufficient intake who have suffered calcium depletion, this will be manifested by certain conditions in the osseous and dental structure, and by a decreased excretion in the urinary output, showing that absorption and retention of calcium in the body have been increased. The absorption of calcium from the intestinal tract into the blood stream is in general promoted by factors which tend to keep calcium in solution in the intestines, the amount of intake in correct proportion to the amount of phosphate and to the proper utilization of fats and fatty acids. Anything which tends to produce an acidosis or to provide a more acid medium in the intestines exerts a favorable influence on calcium absorption because it transforms calcium phosphate, carbonate and soaps into soluble salts and permits the elimination of more fatty acids in the free acid state. Poor utilization of

fats and fatty acids interferes with absorption because it leaves fatty acids in the intestines to form insoluble calcium soaps.

Although acid may improve absorption in the intestines, it may, if introduced in sufficient amounts to cause systemic acidosis and dehydration, lead to excessive loss of all basic metals including calcium in the urine.

In starvation, calcium and phosphorus losses occur probably from two causes: one, the constant excretion of these minerals in feces and urine, which does not cease when the exogenous supply is reduced or stopped; two, the acido-



sis of starvation which tends to decalcify bones. Lennox, O'Connor, and Belinger detected no reduction of serum calcium in individuals who had been starved for periods of from three to twenty-one days.

Some knowledge of the course calcium takes through the body and the way it is utilized and disposed of is necessary, also very interesting. Chart I will perhaps tend to clarify this to some extent. Here I have tried to show how the normal intake of the adult and child is disposed of with the relative percentages. These percentages vary to some extent, but on the whole are fairly constant. In children, during the growth and development period, we find a considerable change in the percentage of the assimilated intake, which is spoken of as the

soluble portion. Here the percentage rises as high as 60 to 70 per cent, with an excretion through the urine as low as 5 per cent, showing that nature is retaining this extra amount in the body to consolidate and stabilize the growing structure.

The course that phosphorus takes through the body simulates that of calcium to a great extent with the exception that the percentage of excretion differs. Here we find that acids augment the absorption of phosphorus as they do that of calcium, while an alkalinity in the intestinal tract has the opposite effect.

For the absorption of phosphorus and calcium, it is necessary not only that both elements be ingested in sufficient amounts, but also that conditions in the intestines be favorable. Great excess of either element may prevent absorption of the other by converting it all into insoluble calcium phosphate. Conditions that diminish the solubility or promote the precipitation of the phosphorus in the intestinal tract tend to reduce the amount excreted in the urine and increase that in the feces; vice versa, anything that favors solubility of phosphate in the alimentary tract augments absorption and increases urinary phosphorus at the expense of feces. Thus diets high in calcium and low in phosphorus lead to high fecal output and phosphorus deficiency because of the formation in the intestinal tract of the insoluble precipitate calcium phosphate. It has been proved that the intake of fat is essential for phosphate absorption for the reason that it combines with the calcium present existing in the form of soaps, thereby preventing the formation of the insoluble calcium phosphate, and the degree of deviation of phosphorus from the feces to urine is roughly in proportion to the amount of fatty acids in the feces.

In the study of bone we must bear in mind that while it is one of the hardest tissues in the body, it is a living tissue and should be given consideration as such. It is capable of undergoing changes both in form and in structure in response to either local or general influences; also it is in a constant process of resorption and replacement. The maintenance of normal bone structure is dependent upon a delicate balance between these two processes. On this balance which is less stable than it appears to be, there are several factors that may influence, and every modification of any of these factors is capable of bringing about a change in normal balance.

In the structure of bone, the trabeculae forming the framework surrounding the medullary spaces have been proved to be the storehouse of calcium or the calcium reserve of the body. The medullary spaces are filled with a fibrous tissue which is very favorable to calcification, and as calcification increases, new trabeculae are formed, closing the areas of these medullary spaces until such a condition is reached that it is impossible to differentiate them.

With a decalcification, there is an enlargement of the medullary spaces from the loss of the trabeculae or separating walls, these spaces being filled with fibrous tissue, resulting in hyperplastic or spongy bone. These conditions are well illustrated by comparing the outer and inner sheaths of bone.

In the process of ossification, nature first provides a fibrous matrix into which are precipitated the calcium combinations, stabilizing and making a rigid supporting structure which we call bone. The different degrees of rigidity depend upon the amount of calcium salts deposited in this fibrous tissue.

Quoting from Rosewarne: "It is in the treatment of a very wide range of disorders of metabolism, from pronounced rickets, with all its concomitants of deformity, stunted growth, and nervous disease, to the host of indefinite causes of debility, inanition, and lowered resistance to infection, that actino-therapy has proved of the greatest service. In all these conditions it is a veritable specific without any rival in the whole series of remedial systems. Ossification consists chiefly in the deposition of lime and phosphorus. Both elements are, however, contained not only in the bones, but also in every cell of the body, and the importance of proper calcium and phosphorus metabolism cannot, therefore, be exaggerated—the point of immediate interest is that radiation is the all important factor in the complex."

The medical and dental professions have begun to realize that it is not so much the amount or the combination of foods that we eat, as how food is utilized in the body. We may have more than the necessary amount in our normal intake and still fail to assimilate it, or we may assimilate and retain too much and fail to eliminate the surplus.

We speak of a balanced diet, of establishing the calcium phosphorus balance, of maintaining endocrine balance, all of which are essential and all of which nature will maintain for us with a little assistance.

True it is that in the body every motive force is balanced by a retarding force, and this equilibrium is quite essential to the proper regulation of the numerous cellular functions.

The cycle of life through which we pass has several different stages. From the time of conception until death, the body tissues are in a continual process of destruction and repair. This process we speak of as the metabolism of the body tissues, and the forces that are involved are the forces which are known as life. During the growth and developmental period, these activities are very great, gradually slowing down until we reach the age of maturity, where we go along on a fairly level plane. Our metabolic activities are fairly well balanced until such a time as we begin slowly to decline, with the metabolic processes gradually growing slower and slower until they cease to function altogether.

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BUILDING GOOD TEETH

A STORY FOR THE THIRD GRADE

C. CARROLL SMITH, D.D.S., PEORIA, ILL.

OUR teeth are built by the food we eat.
Our teeth will be strong if we eat the right kinds of food.
The best tooth food for girls and boys is milk.
Milk has more lime in it than any other food.
Lime is needed to build strong teeth and bones.
Milk may be used in cooking vegetables.
Milk may be used with eggs.
Milk may be used in making custards and desserts. Fruit may be mixed with the custards.
Milk is very good to eat on breakfast foods.
Orange juice is very good to eat with milk.
Tomato juice is good to eat with milk.
When we drink milk we are really eating it.
We are eating milk when we eat butter, cheese, cottage cheese, ice cream, buttermilk and skim milk.

Fruit is a very important tooth building food.
Fresh fruits are very good for us to eat. They supply certain things that the body needs to make good teeth and bones.
Dried fruits are rich in mineral elements which the teeth and bones need to make and keep them strong.
Fresh and dried fruits are much better for us than candy. The natural sugars which are in them do not harm the teeth. Candy sugars do not build strong teeth.
Fruit juices and tomato juices are good health foods for the teeth.
Oranges, apples, grapefruit, lemons, bananas, dates, figs, prunes, raisins, apricots, and other fresh and dried fruits provide building material for good teeth and bones.

Vegetables are of great value as health foods to build strong teeth.
The vegetables with leafy tops are rich in mineral elements.
These mineral elements are very important for tooth growth.
The leafy vegetables are: lettuce, cabbage, spinach, beet greens, turnip tops, brussels sprouts, dandelions, water cress, celery, cauliflower.
All other kinds of vegetables have good food values and should be eaten in large amounts. These vegetables are: beets, carrots, turnips, onions, tomatoes, squash, peas, beans, radishes.

Raw vegetables are very good tooth building foods.

Vegetable salads are healthful dishes to serve at the table.

Cooked vegetables are also of value and may be eaten liberally in connection with milk, cereal, eggs, lamb, beef or fish, fruit, and whole-wheat bread.

If you are faithful in your choice of food from the suggestions given you in this story, you will be doing much toward making and keeping good, sound teeth. Remember that milk, fruit, and vegetables, along with eggs and fish or lamb or beef, cereals and whole-wheat bread, combine to form a well-planned diet. This is spoken of as a balanced diet. It helps to make and keep our teeth strong. Good, clean teeth help to keep us well and comfortable and happy.

Clean, pretty teeth put life and joy into our smile.

Do you keep your teeth clean?

GROWING AND PROTECTING OUR TEETH

A STORY FOR THE FIFTH GRADE

C. CARROLL SMITH, D.D.S., PEORIA, ILL.

TEETH are a living part of the body and depend upon food for growth and protection.

With the right building material given it, the human body can build teeth so strong and perfect that decay cannot touch them.

Food is the material that nourishes and sustains the body; it becomes a part of the body itself. It is important that this food be clean and that it be well chewed before it goes on its way to build up body substance.

In making a cake, you would not put your flour, butter, baking powder, eggs and flavoring in a pan and then into the oven without properly mixing them and expect them to result in a good cake. All of the materials for a good cake are there, but if they have not been properly mixed the cake will be a failure. Just so with the body. If the food taken to nourish the body is not properly selected and properly prepared in the mouth, the results in bodily health are not what they should be. The body weight must be kept normal. Enough and proper food material must be taken into the body to replace the bone, muscle and other body substance worn away by use.

Whatever promotes good health helps to grow strong, solid, healthy teeth. Fresh air, sunshine, nourishing foods well chewed, exercise, clean and comfortable surroundings, plenty of sleep, good habits—these are the things needful to produce good tooth structure.

If teeth are not good, if they are soft, decay easily or are defective in other ways, they require even greater care. With proper food and proper care, even poor teeth may be preserved for a long time.

In spite of the best care you are able to give your teeth, they may become discolored, lime deposits may form on them, or some decay may take place. You may avoid this by visiting your dentist regularly. How often, should be left to the judgment of the dentist. In very few cases should these visits be less frequent than twice a year. It is an old but very true saying that "A stitch in time saves nine."

It has been said that "A man is known by the teeth he keeps." If you see men and women with good clean teeth, you will feel that they are clean healthy people. A clean, well-cared-for mouth is sure to command respect.

One lady asked her dentist, "How often shall I clean my teeth?"

Knowing that she prepared her own food, he said, "How often do you clean your pots and pans and cooking utensils?"

"Why," said she, "as often as I use them."

"Then," replied the dentist, "that is how often you should clean your teeth."

Remember to keep your teeth clean on all their surfaces, all the time. Do not forget that clean teeth, well cared for, and food well chewed, are friends to good health, a sound body, and a keen mind.

Just inside the threshold of the body, nature has placed two rows of pearls. These pearls are of great value. Their equal cannot be bought at any price. They are priceless jewels and should be valued beyond riches. Once lost, the world's billions cannot replace them. Protect them, care for them, keep them clean. They are your birthstones of good health and, well guarded, add to your success and happiness through life.

Good clean teeth kept in good repair are elements of good health and respectability.

THE HUMAN MACHINE

A STORY FOR THE SIXTH GRADE

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IF YOU had a new car, would you expect it to run without proper fuel in the radiator and battery or with an inferior quality of gas or oil?

Would you expect your car to run smoothly if the spark plugs became dirty or the engine was allowed to accumulate carbon or if the valves were not ground at the proper time?

Would you try to run it without repairs until the piston rings dropped out or when the brake system needed adjusting?

Would you expect the car to hold up if you did not change the oil at the proper time or if you ran it until the oil gave out?

Would the tires of your car hold up if you did not keep them filled with a proper pressure of air? If you had a puncture, would you continue to drive on the flat tire? If not, what would you do?

The good mechanic keeps his car in perfect running order. The minute he detects the slightest defect in the running gear, he investigates to find the cause of the trouble. To operate an automobile successfully, one must understand something of the mechanism of the machine. Careful thought and balanced judgment are essentials to intelligent management of the machine, and it is just as necessary to apply good thinking and balanced judgment to one's own living machine.

Some people take better care of their cars than they do of their bodies.

Have you ever considered what a remarkable machine your body is? It is a very interesting human machine. It has power to take care of its own growth, to repair its own injuries and to renew its worn-out cells.

In order to keep this human machine in the most perfect condition, it must have the right kinds of food to run on. You cannot run your body on inferior or insufficient food, any more than you could run your car on vinegar or hair oil.

But even if you give your body good nourishing food, and yet allow your mouth to be unclean and your teeth to get out of repair, you are mixing with that food decayed matter that can do serious damage. In other words, if you let the spark plugs become too dirty your human car will not run, even though you have the best food fuel in the world.

It takes a high degree of common sense and intelligence to keep this complicated human machine in order, and to diagnose its trouble when it gets out of order.

It is common sense to prevent mouth and tooth troubles through intelligent care of the teeth and gums, by eating proper foods, and by regular trips to the dentist.

If you should break your arm would you go to a surgeon to have it set? Are you as careful about going to a dentist if you have trouble in your mouth?

If you are wise you will visit your dentist regularly and let him help you to keep your food engine in good condition and your dental spark plugs clean.

Take good care of your teeth and your teeth will help to take good care of you.

To lay a foundation for dental health we must begin with the food we eat.

Teeth must be fed to make them grow just as the rest of the body needs food to make it grow. We cannot afford to neglect the care and nourishment of the food engine of our human machine.

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Observations on Teeth of Chinese. By S. A. Montelius, J. Dent. Res. December, 1933.

A total of 4,474 Chinese were examined, males and females, and belonging to various social strata.

A very high percentage (79 per cent) presented the so-called "*shovel-shaped*" incisors, which are characterized by highly developed mesial and distal marginal ridges. (Incisors of a similar shape have been described in American Indians.) The second mandibular molar, which in the white race carries four cusps, has frequently (56 per cent) five cusps among the Chinese. However, variations in number and size of cusps are not infrequent, and the theory may be advanced that the fifth cusp is gradually becoming scarce and may completely disappear in the future.

An *overbite* of the maxillary incisors over the mandibular incisors predominates, varying from mild to excessive degrees. It is in many cases accompanied by an overjet of the maxillary anterior teeth. The high frequency of overbite is evidenced by the fact that 89 per cent presented it. End-to-end bite occurred in 6 per cent. Only 20 individuals had mandibular incisors protruding over the maxillary incisors. (It is not stated whether a true mesiocclusion condition accompanied these cases.) Altogether, irregularities were found in 33 per cent of cases.

Occlusal abrasion in the molar region was far greater than that usually found among other races. Of 4,466 individuals, 977 showed occlusal abrasion (21 per cent), although most persons examined were only from ten to twenty-nine years old.

Mottled and chalky enamel was often seen, and always endemic in certain regions. *Calcareous deposits* on the teeth were common (92 per cent). *Gingivitis and pyorrhea* occurred with great frequency (81 per cent). The number of *carious teeth* was only 8 per cent of the total examined. Contrary to conditions in the white race, the maxillary molars are more susceptible to decay than are the mandibular molars.

The soldier group showed higher percentages of gingivitis and pyorrhea. The student group showed higher percentage of malocclusions and caries. This may be due to the increased modernization of living conditions in the

latter group. *The association of caries with malocclusions should be noted. Furthermore, caries appeared with 10 per cent greater frequency in individuals having irregular teeth.*

—E. N.

Diet and Bone Development. By Dr. William J. Corcoran, J. A. D. A., April, 1934.

The discovery of the vitamins has made the orthodontist food conscious. In many instances, where treatment results are unsatisfactory, he turns his attention away from appliances to a more intimate study of the tissues with which he has to deal. Nutritional agents play an ever increasing rôle in his orthodontic instrumentarium, but the importance of diet must not be allowed to overshadow other significant requirements of health. Dr. Corcoran makes a clear and systematic survey of the food problem in bone development, but not without pointing to those other factors which must be considered in bone growth, besides diet.

Is everyone living in a state of calcium deficiency? Is the so-called balanced diet adequate for normal bone growth? Is there another factor determining the state of bone development besides the dietary?

In an examination of 5,000 children it was found that a large number showed bone hypoplasia despite the fact that their diets were well balanced. On the other hand, a large number of children, whose dietary was definitely deficient, had no signs of bone hypoplasia. The conclusion was finally reached that in the majority of cases diet was a predisposing rather than an active factor in faulty bone development.

The problem is further complicated by the fact that, due to recent discoveries in food metabolisms, manufacturers have placed various new food products on the market. There are more kinds of foods, tastes, and mental appetites now than there ever were before.

BASIC ELEMENTS OF FOOD

However, if we apply a critical analysis to the foods which constitute our meals, we find that they consist of certain basic elements, namely: milk, eggs, vegetables, grains, fish, meat, and fruit. The Neanderthal man depended on these, and our own fanciful dishes consist of them. We are still eating nature's primary foods, even if they are presented to us under different names.

Junket is milk.
Custard is eggs.
Cookies are grains.
Prunes are fruit.

BALANCED DIET

Balanced diet is a combination of foods in the same chemical composition as they are found in the human body. These chemical materials consist mainly of: carbohydrate, protein, fat, salt, water, and vitamins.

Protein should supply 10 to 15 per cent of the total food.

Carbohydrates should supply 60 to 75 per cent of the total food.

Fat should supply 10 to 30 per cent of the total food.

Phosphorus is required in amounts of 0.25 to 0.5 gm. daily.

Calcium is required in amounts of 0.5 to 1.0 mg. daily.

Iron is required in amounts of 7 to 10 gm. daily.

Vitamins are adequately furnished by 30 gm. orange juice and 8 gm. cod liver oil.

INDIVIDUAL REQUIREMENTS

After the consideration of basic food elements and their utilization in a balanced diet, we must further concede the fact that each child is an individual. And while we know which diet will generally produce normal bone growth, we do not know what constitutes normal bone growth in an individual child. Phenomena of endocrinology and of metabolism have to be taken in account. As an example, a child with delayed dentition was studied. The child was placed on a balanced diet, including vitamins and dicalcium phosphate. But because it was an individual child, the eruption was not accelerated until a little iodine was added to stimulate the deficient action of the thyroid.

For this reason, we should not think of diet and bone development in terms of so much salts, proteins, and vitamins, but we should recognize the interrelationship of all factors dealing with absorption, distribution, and utilization. Not all of these factors are thoroughly understood. This is the explanation of why children receiving adequate amounts of mineral salts may have faulty bone development. Insufficient sunlight, excess of fats, dysfunctioning parathyroids, chronic infections, or something not so evident, may be to blame. It would, for instance, be interesting to determine how many children present faulty bone growth not because of an inadequate supply of mineral salts, but, let us say, because of an abnormal protein metabolism.

—E. N.

Fisher's Orthodontic Directory of the World. Edited by Dr. Claude R. Wood, Knoxville, Tenn., 1934.

After an interval of two years the orthodontic directory has again been published, now named in honor of its founder, Dr. William C. Fisher. It contains a list of all practicing orthodontists in the United States and in foreign countries. The listing includes: name, address, year of graduation from dental school, postgraduate orthodontic school attended and year of graduation, membership in orthodontic societies, statement whether practice is limited to orthodontia.

It is gratifying to know that this valuable publication is to be continued. In present times the tendency of people to change their place of residence is pronounced. Invariably, a patient, when leaving us for another city, asks for a recommendation. It is at such a time that the orthodontic directory comes in handy. If the recommended orthodontist is not personally known to us, his postgraduate training will give us a certain amount of information regarding the methods which he uses. In this way, an orthodontist may be selected who will carry on our plan of treatment, more or less unchanged.

—E. N.

International Journal of Orthodontia and Dentistry for Children

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EDITORIAL

The New York Meeting of the American Society of Orthodontists Next Year

UPON request of the editor of the INTERNATIONAL JOURNAL OF ORTHODONTIA AND DENTISTRY FOR CHILDREN, Dr. Leuman Waugh, president of the American Society of Orthodontists, has provided this Journal with advance information pertaining to the great meeting of the American Society of Orthodontists planned for 1935. Judging from the information received from Dr. Waugh, New York is making many plans for the thirty-fourth annual meeting of the Society. The president points out, strange as it may seem, that it has been more than a quarter of a century since the organization has

held a regular meeting in the city of New York. He advises that the New York Society of Orthodontists is enthusiastically endeavoring to complete plans for what is believed will possibly be the largest and at the same time one of the best meetings in the history of the organization.

To quote from the information secured from the president: "From Monday morning until Friday evening there will be offered a continuous and varied program of the practical, the scientific and the social, that will be so magnetic that it is hoped to attract more members from all sections than have ever before attended an annual meeting. Especially it is expected that this will appeal to the wives and families of the members. Much of interest is being arranged of both artistic and practical value. While the members are attending sessions during the day, the ladies will be escorted on sight-seeing and shopping trips, to Radio City to hear the best music, to visit the Metropolitan Museum of Art and many other places of special interest. The evenings are being left open for the recreation of the members. Only on Wednesday evening is a function scheduled, a banquet in the world famous Grand Ballroom of the Waldorf-Astoria. The committee is planning a banquet without speeches which every one will want to attend.

"The Program Committee has plans so well in hand that a most practical and scientific series of presentations in the form of papers, clinics, and case reports, is assured. The clinics will be both of the 'general' and of the 'progressive educational' type.

"The scientific exhibit is well under way and will offer unusual opportunity for study of the natural development of the teeth, jaws and face, and of individual variations in growth. This will be arranged in cases especially designed for the purpose and will be carefully labelled, and there will be attendants to explain the salient features. This exhibit will be open from Monday morning until Friday night in order to afford every one the opportunity for study. Those who wish may spend all day Monday and their evenings here.

"Every committee, in fact, has its work well organized and will report at a later date.

"The management of the Waldorf-Astoria has been most gracious in setting aside the entire ballroom floor for the meeting. The daily sessions will be held in the Grand Ballroom, famous for its beauty and completeness of equipment, including voice amplification and projection of still and motion pictures. The adjoining halls will house the scientific exhibit and the clinics.

"In this, the most renowned hotel of the nation, it is felt that the members will enjoy an atmosphere of quiet and refinement, harmonious with the ideals envisioned by the pioneers of modern orthodontics, and that it will be stimulating to the development of the best that is in each of us."

It will be seen from the foregoing remarks and it is obvious from information gathered from various sources that New York is planning great things for the thirty-fourth annual meeting of the American Society of Orthodontists. Orthodontists from all over the world will, no doubt, begin

to make their plans far in advance to attend the meeting. The inspiration and enthusiasm which the individual orthodontist gains from attendance at these meetings make the time and expense the most profitable investment which he can make.

There will be innovations at this meeting, and precedents will be thrown in the discard. For instance, a banquet without speeches not only is an innovation but will be welcomed by many as literally the dawn of a new day. Without enthusiasm, nothing—to develop enthusiasm, attend meetings. To attend meetings, make your plans far ahead—build a blue print accordingly.

H. C. P.

BOOK REVIEWS

Bacterial Infection

Bacterial Infection. With Special Reference to Dental Practice. By J. L. T. Appleton, Jr., B.S., D.D.S., Professor of Microbiology and Bacteriopathology, the Thomas W. Evans Museum and Dental Institute, School of Dentistry, University of Pennsylvania. Published by Lea & Febiger, Philadelphia. Second edition, enlarged and revised, published 1933, 654 pages, 122 illustrations and 4 color plates.

In the new edition of this important work, the revision has been very complete. Such are the advances in knowledge that nearly two hundred pages have been added to the text, including new chapters on oral manifestations of extraoral infections, several chapters on the discussion of periapical infection and a chapter on oral hygiene. Radical changes in the sequence of some of the other chapters have been found advisable, and the arrangement throughout is believed to be more natural and clinically more useful than in the previous edition.

The primary purpose of the book remains the same, namely, to aid the reader to form a comprehensive concept of infection and an understanding of its bearing on the problems of dental practice. The aim has been to give the dentist the knowledge that will aid him in understanding or in solving his problems. The practitioner of medicine who is aware that infection in one part of the body may have an influence on the general health of the patient or the health of other more or less remote parts, will find in this book much of interest, particularly in Part III. The dentist and the physician should speak the same language if they are to attain that closer cooperation which is admitted to be so desirable. The author has aimed by stressing these fundamental principles to make his book equally interesting to the dentist and to the physician.

Part I endeavors to acquaint the reader with the fundamental information on the morphology, physiology and ecology of bacteria, and with sterilization of chemicals and heat. Part II treats the subject of infection as an entity. Part III presents a full summary and critical analysis of what is known about common infections associated with the oral cavity. This book aims to stimulate the dentist's interest in acquiring a knowledge equivalent to that possessed by the physician of what infection means. Such a knowledge is essential to intelligent practice.

This book comes at an opportune time, a time when the members of the dental profession realize the close relationship between infectious diseases and the manifestations in the mouth.

Practical Anesthesia for Dental and Oral Surgery

Practical Anesthesia for Dental and Oral Surgery. Local and General.
By Harry M. Seldin, D.D.S. Published in 1934, by Lea & Febiger, Philadelphia.

This book fills the need for a comprehensive, accurate and practical textbook on dental anesthesia, both local and general. The author believes that these two branches should be treated in a simple volume and with equal emphasis. Both are important; they are intimately interrelated and each has its place. The skilled anesthetist should be able to decide which anesthetic agent is best suited to the particular case in hand. To aid him, this book gives full consideration to the indications and contraindications and to the unusual conditions which militate against the use of one or the other.

The emphasis on physical diagnosis enables the dentist, the exodontist or the oral surgeon to estimate the physical state of his patient, without undue delay, by simple and accurate means. The basic aspects of anatomy and physiology are stressed as far as they have a bearing on anesthetic technic and the essential facts are correlated with the dentist's everyday knowledge. Original charts aid in organizing the material and in reviewing it, and those giving the equivalent strengths and uses of novocaine preparations will be particularly useful.

This book should be added to the library of every dentist who is interested in the subject of anesthesia. It is full of practical knowledge and useful suggestions.

NEWS AND NOTES

The American Board of Orthodontia

A special meeting of the American Board of Orthodontia for the consideration of new applications will be held in St. Paul, Minnesota, at Hotel Saint Paul during the meeting of the American Dental Association in August.

Those orthodontists who desire to qualify for a certificate from the Board should secure the necessary application form from the Secretary. Applications received up to the date of the meeting in St. Paul will receive preliminary consideration by the Board, and the required examination will be outlined. It will not be necessary for new applicants to appear before the Board at this time. However, such applicants should appear before the Board at the next annual meeting.

Attention is called to the following resolutions adopted by the Board:

Any person desiring to make application to the Board for a certificate shall have been in the exclusive practice of orthodontia for a period of not less than five years or an equivalent to be determined by the Board and based upon the following conditions:

First, an instructor in orthodontia in a school satisfactory to the Board.

Second, an associate in the office of an orthodontist whose standing is satisfactory to the Board.

It is, however, definitely to be understood that any person at the time of making application for a certificate shall be in the exclusive practice of orthodontia in his own name.

ALBERT H. KETCHAM, President,
Republic Building,
Denver, Colo.

OREN A. OLIVER, Secretary,
Medical Arts Building,
Nashville, Tenn.

Southwestern Society of Orthodontists

The 1934 meeting of the Southwestern Society of Orthodontists has been postponed. The time of the next meeting will be announced at a later date.

GUY M. GILLESPIE, President,
Abilene, Texas.

CURTIS WILLIAMS, Secretary,
Medical Arts Building,
Shreveport, La.

Association of American Women Dentists

The thirteenth annual meeting of the Association of American Women Dentists will be held at the St. Paul Hotel, St. Paul, Minn., on August 6, 1934.

A cordial invitation is extended to all women dentists.

GENEVA E. GROTH,
1301 Medical Arts Bldg.,
Philadelphia, Pa.

Southern Society of Orthodontists

The thirteenth annual meeting of the Southern Society of Orthodontists will be held at The Homestead, Hot Springs, Virginia, July 16, 17 and 18.

A cordial invitation is extended to all ethical members of the dental and medical professions.

N. F. MUIR, President,
Shenandoah Life Bldg.,
Roanoke, Va.

WILLIAM P. WOOD, JR., Secretary,
442 W. Lafayette Street,
Tampa, Fla.

Hygiene Commission of the International Dental Federation

The Jessen prize was founded by the Hygiene Commission in 1929. This prize is to be awarded, if possible, every two years, to such organization or individual as shall have rendered the most meritorious service in the field of oral hygiene for children during this period.

The Hygiene Commission of the I. D. F. herewith appeals to the affiliated societies and to the delegates of the various countries, for nominations, suitably documented, of organizations or individuals who in their opinion, should be considered for the award of the Jessen prize, by reason of their work for oral hygiene among children.

These nominations, on which the Hygiene Commission will base its decision, should be forwarded to Dr. Bruske, Jan Willem Brouwerplein 21, Amsterdam, Holland, before June 15, 1934.

For the Hygiene Commission of the I. D. F.

DR. LINNERT (Nuremberg)
President.

DR. J. BRUSKE (Amsterdam)
Vice-President.

DR. C. H. WITTHAUS (The Hague)
Assistant Secretary.

American Society for Promotion of Dentistry for Children

The annual meeting of the American Society for the Promotion of Dentistry for Children will be held at the St. Paul Hotel, St. Paul, Minnesota, August 6, 1934.

Important papers and reports will be given, and important business will be transacted. A discussion luncheon will be held at noon, at which all phases of dentistry for children will be interestingly and informatively discussed.

WALTER T. MCFALL, Secretary,
720 New Street,
Macon, Ga.

Meeting of Psi Omega Fraternity

The annual meeting of the National Alumni Chapter of Psi Omega will be held at the Lowry Hotel, St. Paul, Minnesota, Tuesday morning, August 7.

The annual banquet and ladies' night will be held Monday night, August 6, at 7 P.M. Headquarters and registration will be at the Lowry Hotel.

WALTER T. MCFALL, Grandmaster,
720 New Street,
Macon, Ga.

American Dental Assistants Association

The tenth annual meeting of the American Dental Assistants Association will be held in St. Paul, Minnesota, August 6-10, 1934. Headquarters will be at the St. Frances Hotel. For further information address

RUTH M. CLARK, General Secretary,
Suite 1-4, Scofield Bldg.,
Minot, North Dakota.

Notes of Interest

Dr. E. B. Arnold and Dr. J. S. Cunningham announce the removal of their offices to 3306 Fannin Street, Houston, Texas. Practice limited to orthodontia.

Dr. Glenn F. Young announces the removal of his offices to 745 Fifth Avenue, Suite 1210, New York, N. Y.

Dr. Charles R. Baker, orthodontist, 636 Church Street, Evanston, Ill., announces the opening of a Chicago office at 55 East Washington Street; hours by appointment.

